The GOES-R/16 Advanced Baseline Imager (ABI)

Timothy J. Schmit (tim.j.schmit@noaa.gov)

NOAA/NESDIS/Satellite Applications and Research

Advanced Satellite Products Branch (ASPB) Madison, WI

Plus many, many more…

NSC 2017
New York City, NY
July 2017

UW-Madison

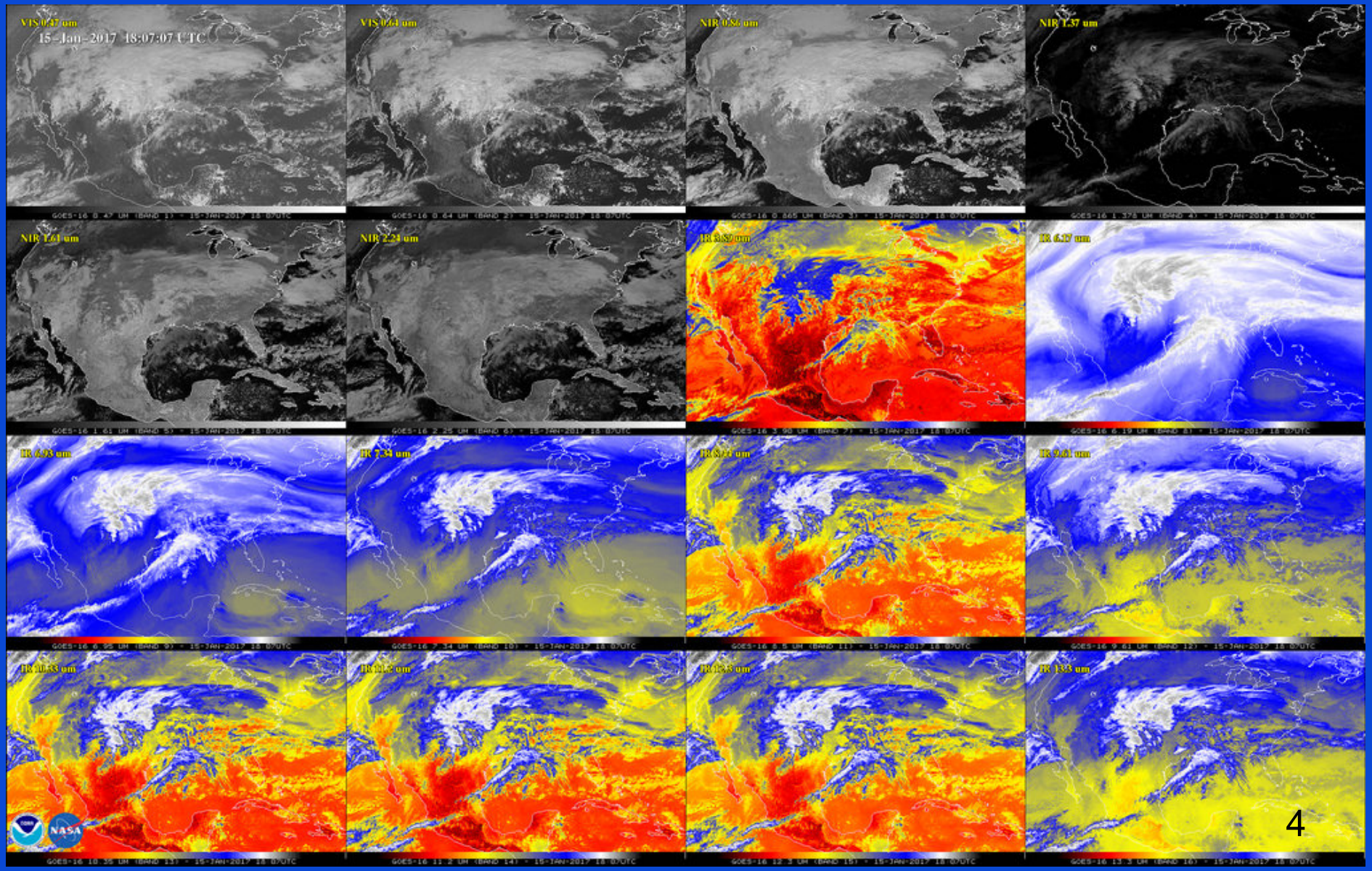
Thanks to…

- Mat Gunshor
- Kaba Bah
- Jim Nelson
- Joleen Feltz
- Hong Zhang
- Jordan Gerth
- Steve Miller
- Dan Lindsey
- Jaime Daniels
- Scott Lindstrom
- Bill Line
- SSEC data center
- Scott Bachmeier
- Paul Menzel
- Steve Goodman
- Chris Schmidt
- Chad Gravelle
- ITT / Harris
- Lockheed-Martin
- Entire GOES-R team!
- Fred Wu
- You.

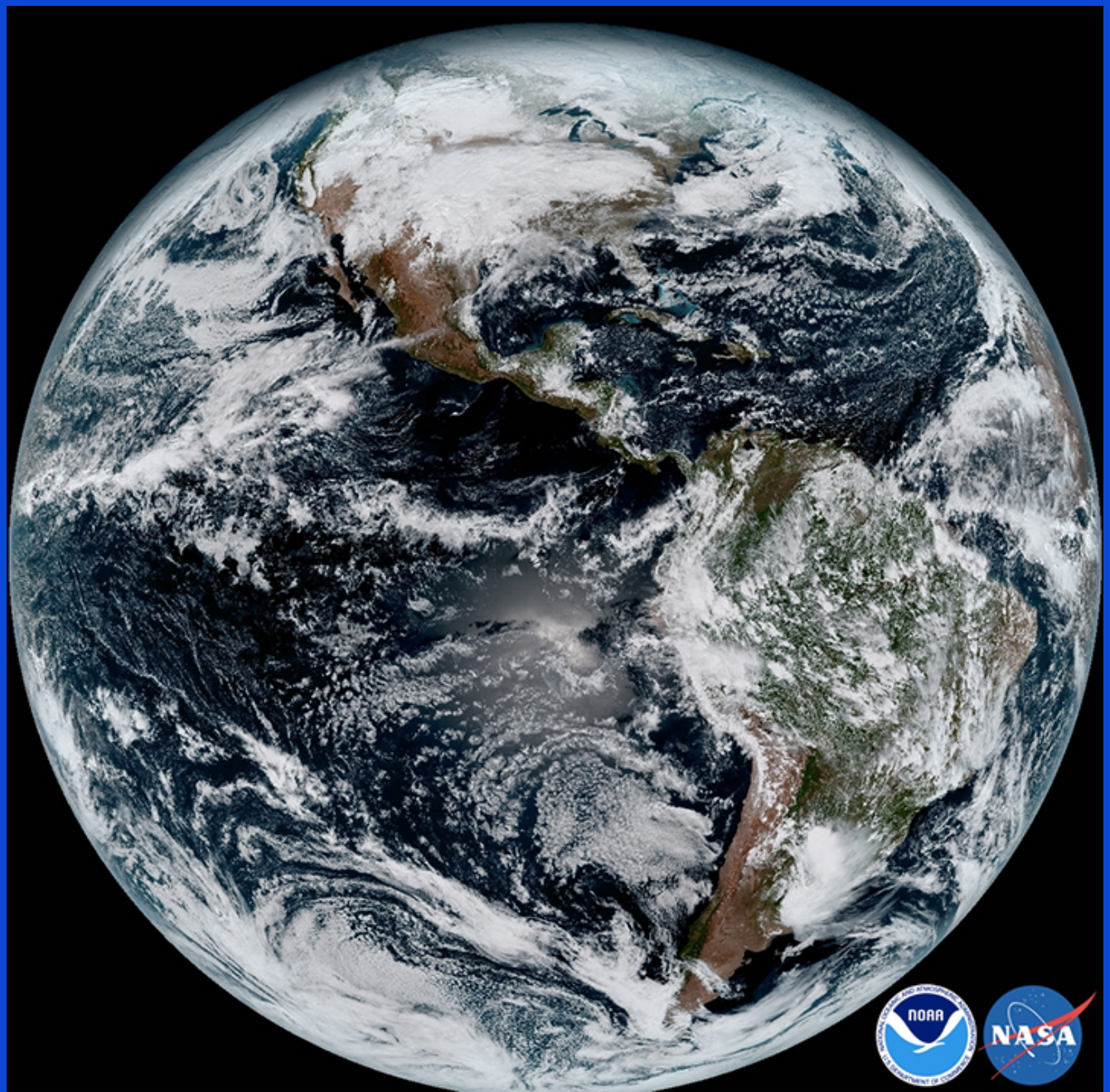
- GOES-R Advanced Baseline Imager (ABI)
  - Spectral
    - Improved!
  - Spatial
    - Improved!
  - Temporal
    - Improved!
  - Calibration
    - Improved!

Lockheed Martin

First Light


VIS 0.47 um
15-Jan-2017 18:07:07 UTC
VIS 0.64 um
NIR 0.86 um
NIR 1.37 um
NIR 1.61 um
NIR 2.24 um
IR 3.90 um
IR 6.19 um
IR 6.93 um
IR 7.34 um
IR 8.44 um
IR 9.61 um
IR 10.33 um
IR 11.2 um
IR 12.3 um
IR 13.3 um

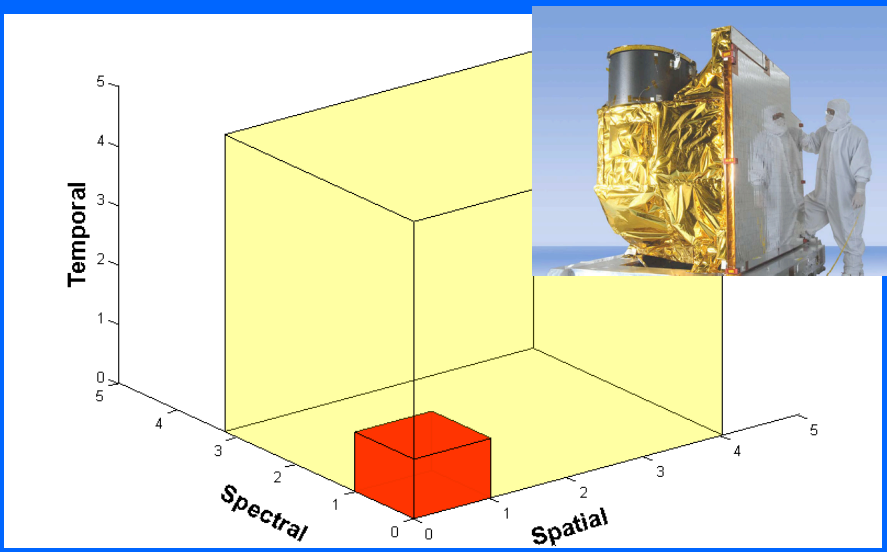
First Light



The Advanced Baseline Imager:

	ABI	Current Imager
Spectral Coverage		
	16 bands	5 bands
Spatial resolution		
0.64 μm Visible	0.5 km	Approx. 1 km
Other Visible/near-IR	1.0 km	n/a
Bands (>2 μm)	2 km	Approx. 4 km
Spatial coverage		
Full disk	4 per hour	Scheduled (3 hrly)
CONUS	12 per hour	~4 per hour
Mesoscale	2 every 1-min	n/a

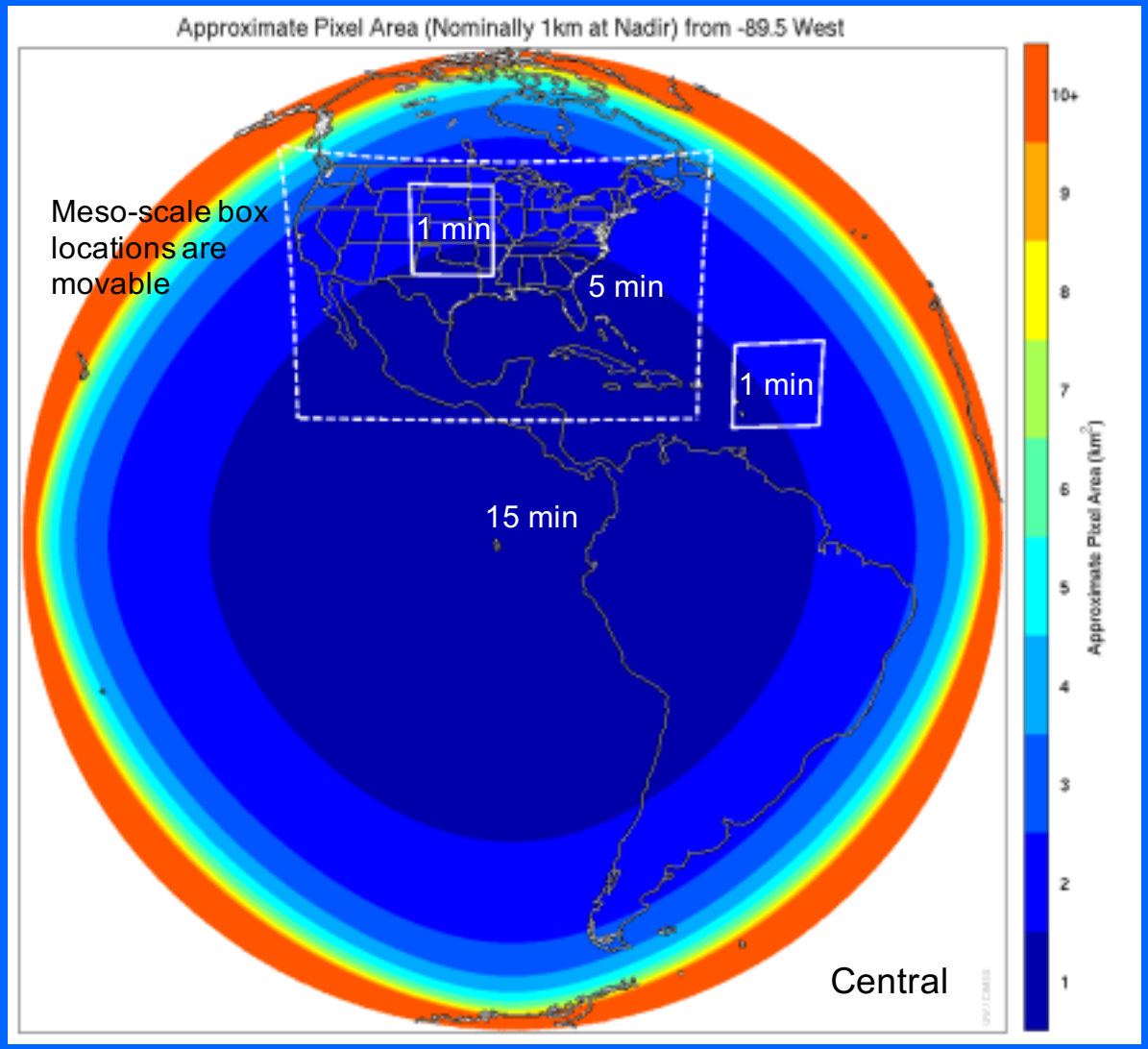
Advanced Baseline Imager (ABI)



5x Faster coverage (5-minute full disk vs. 25-minute)

4x Improved spatial resolution (2 km IR vs. 4 km)

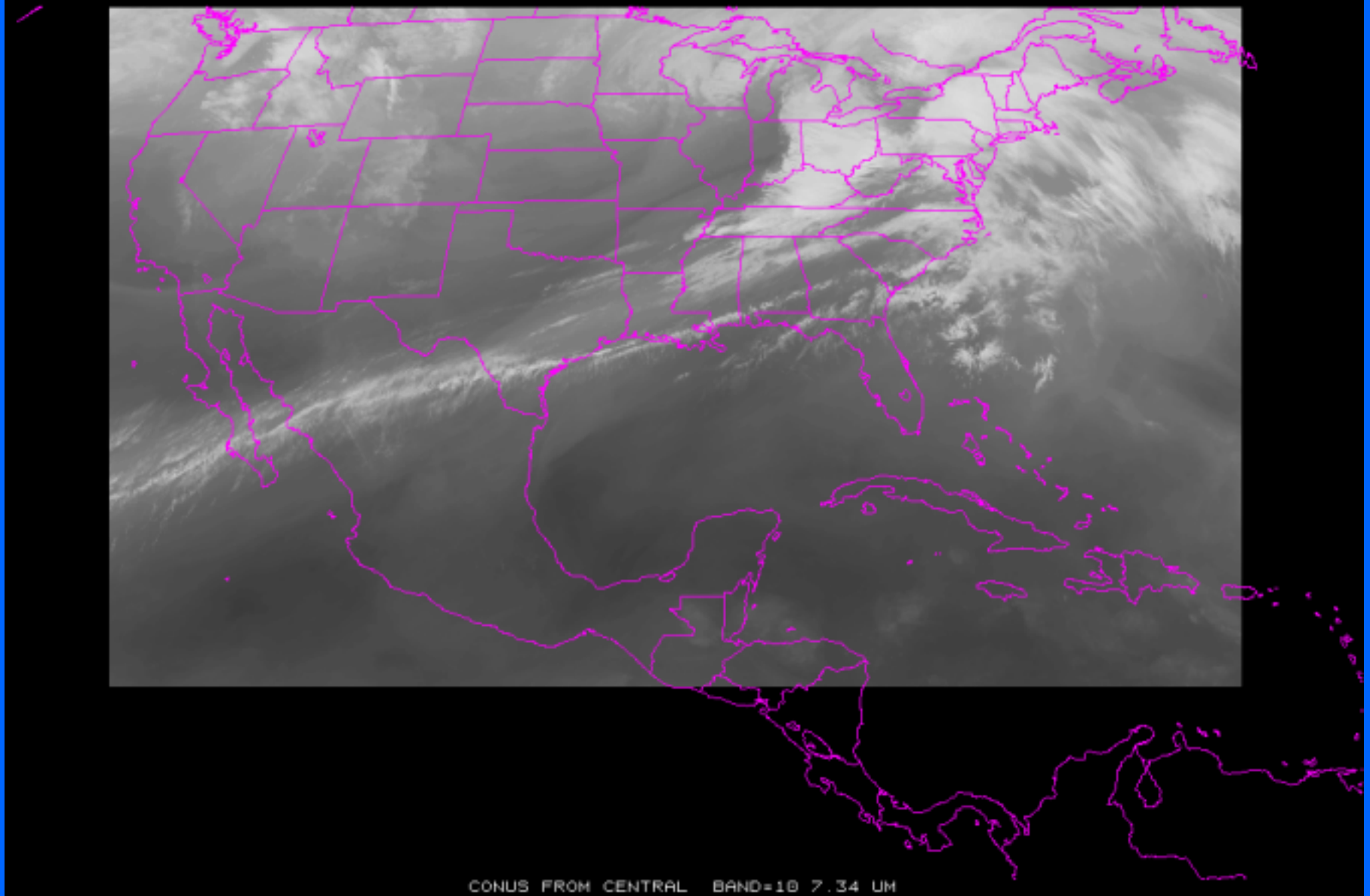
3x More spectral bands (16 on ABI vs. 5 on the current imager)



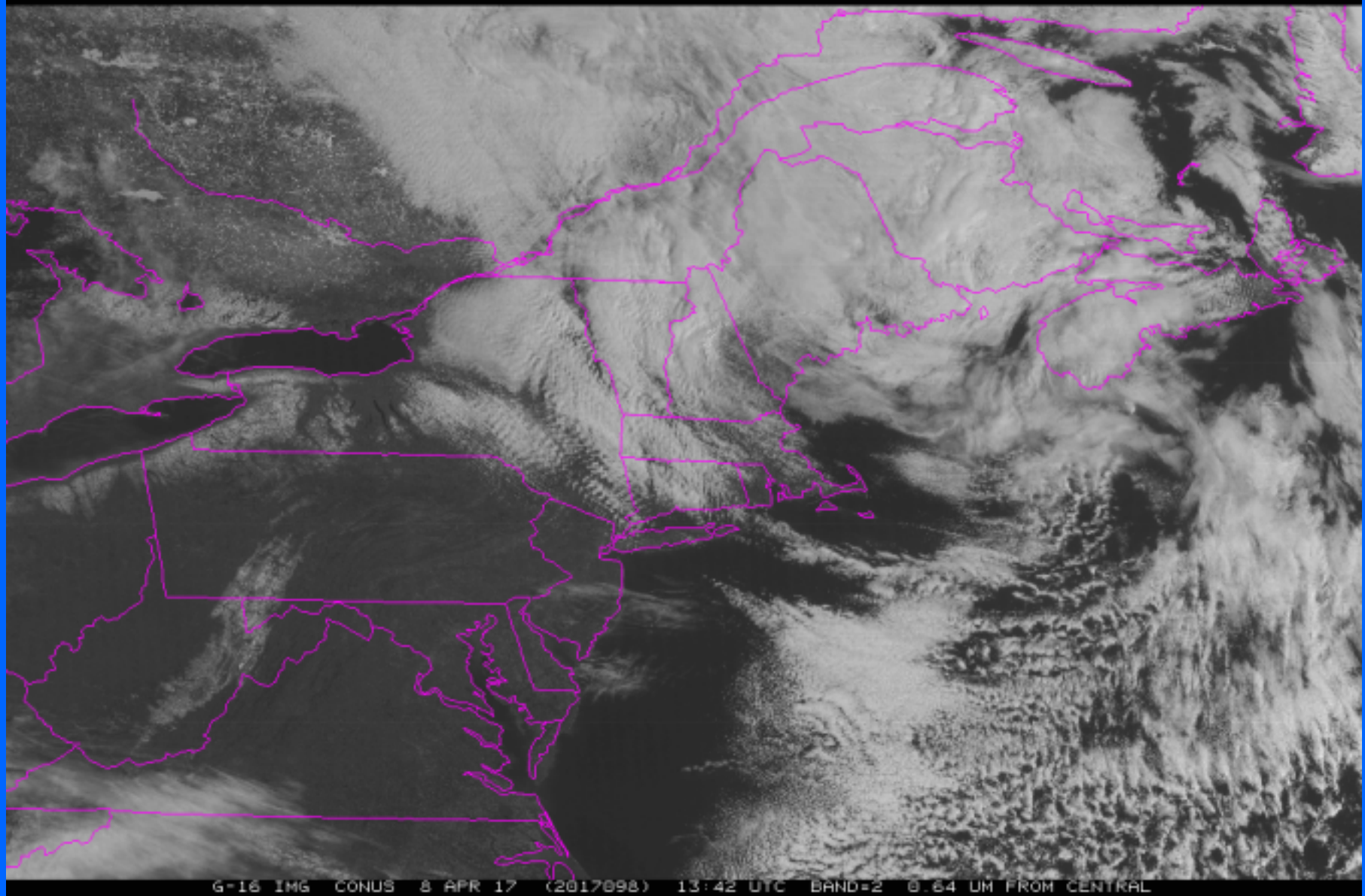
Scan mode (3) or 'flex mode' for the ABI:
- Full disk every 15 minutes + 5 min CONUS
  + 1-min mesoscale sectors (2 locations).

[Scan mode (4) or 'Continuous Full Disk' (CFD) is a full disk every 5 min]

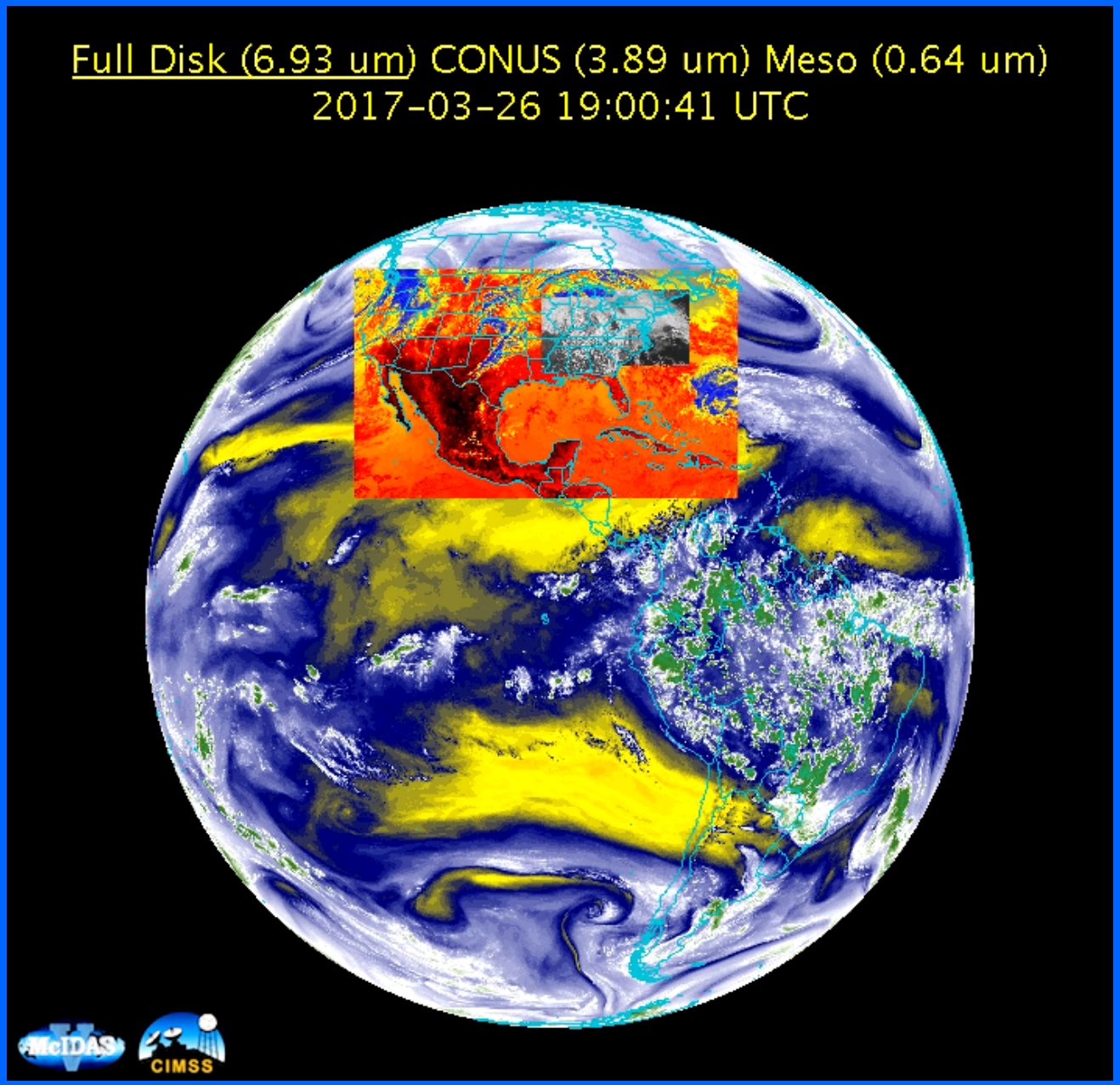
ABI CONUS Sector (Central)



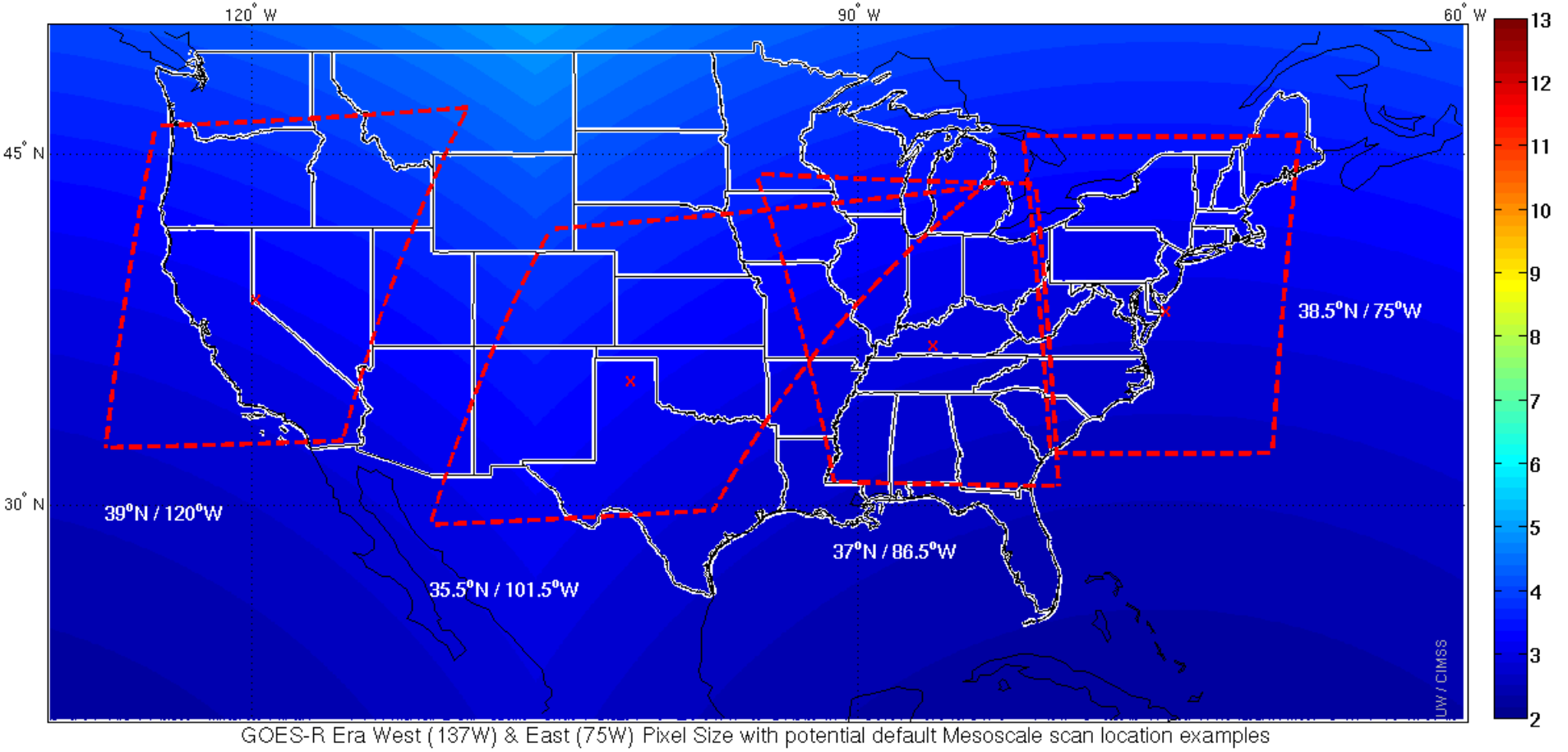
CONUS EXTENT



ABI Sectors


Full Disk (6.93 um) CONUS (3.89 um) Meso (0.64 um)
2017-03-26 19:00:41 UTC
McIDAS
CIMSS

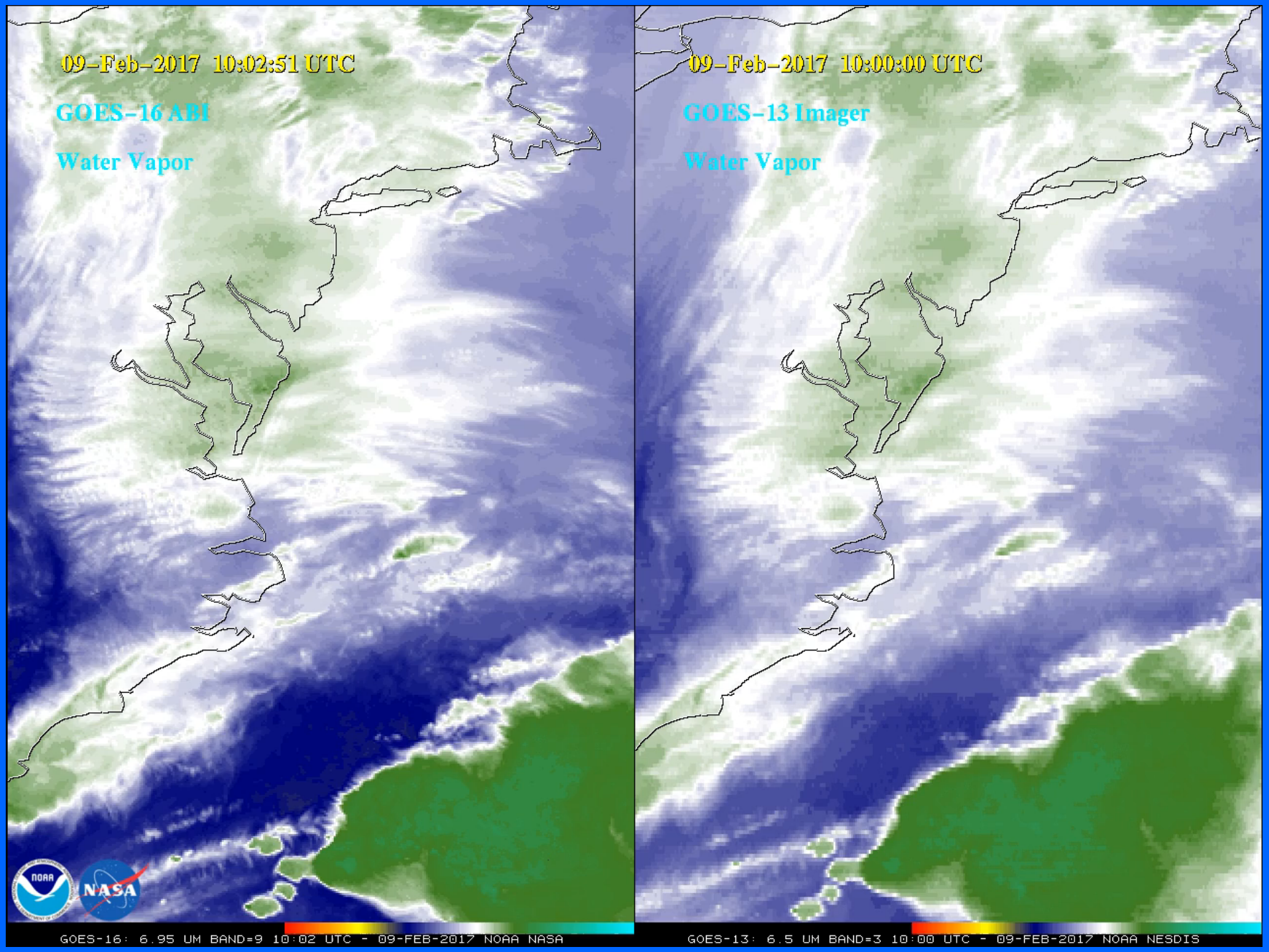
Default Meso Locations



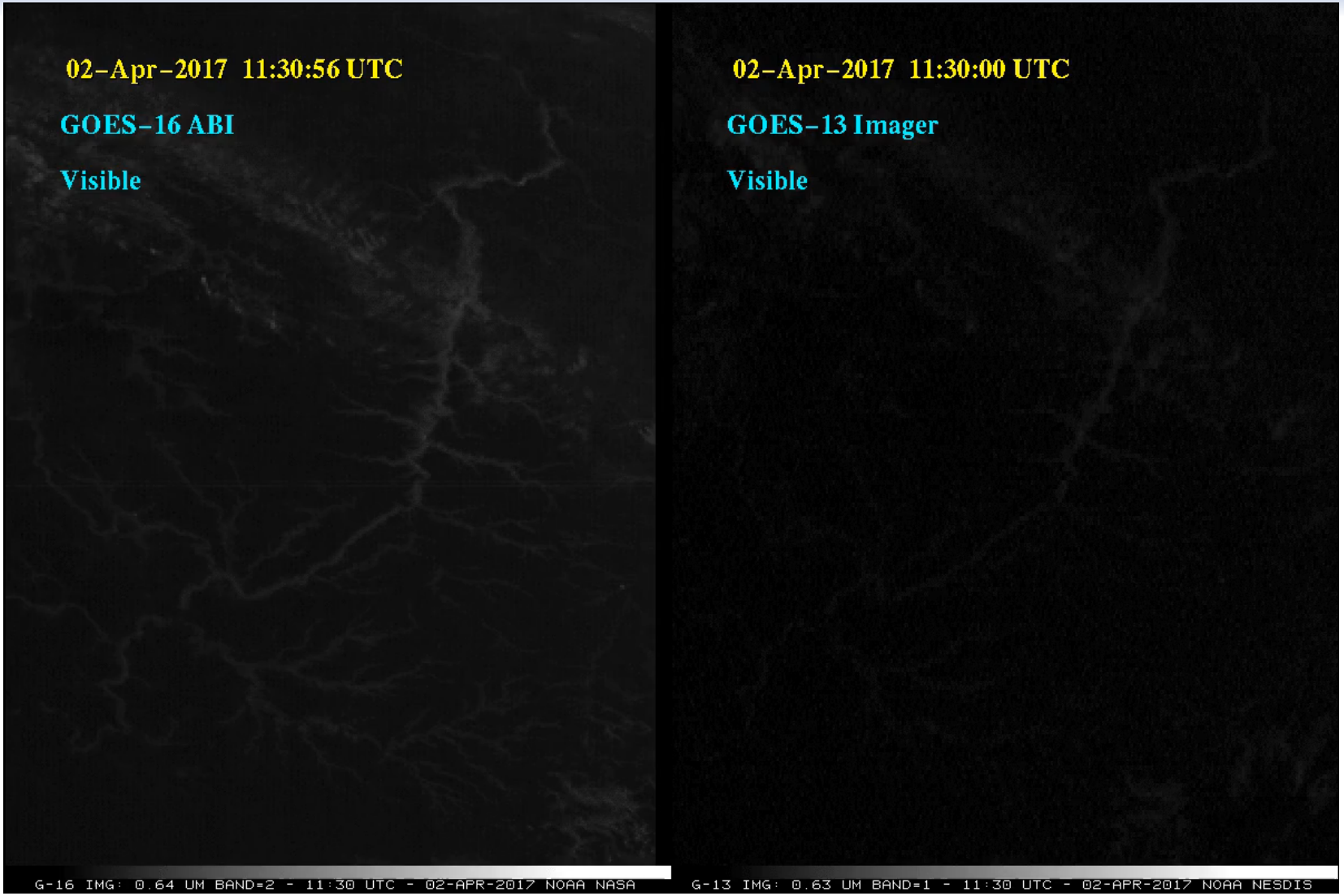
GOES-R Era West (137W) & East (75W) Pixel Size with potential default Mesoscale scan location examples

Two meso from GOES-West and two from GOES-East

ABI vs GOES-13



GOES-16 vs GOES-13

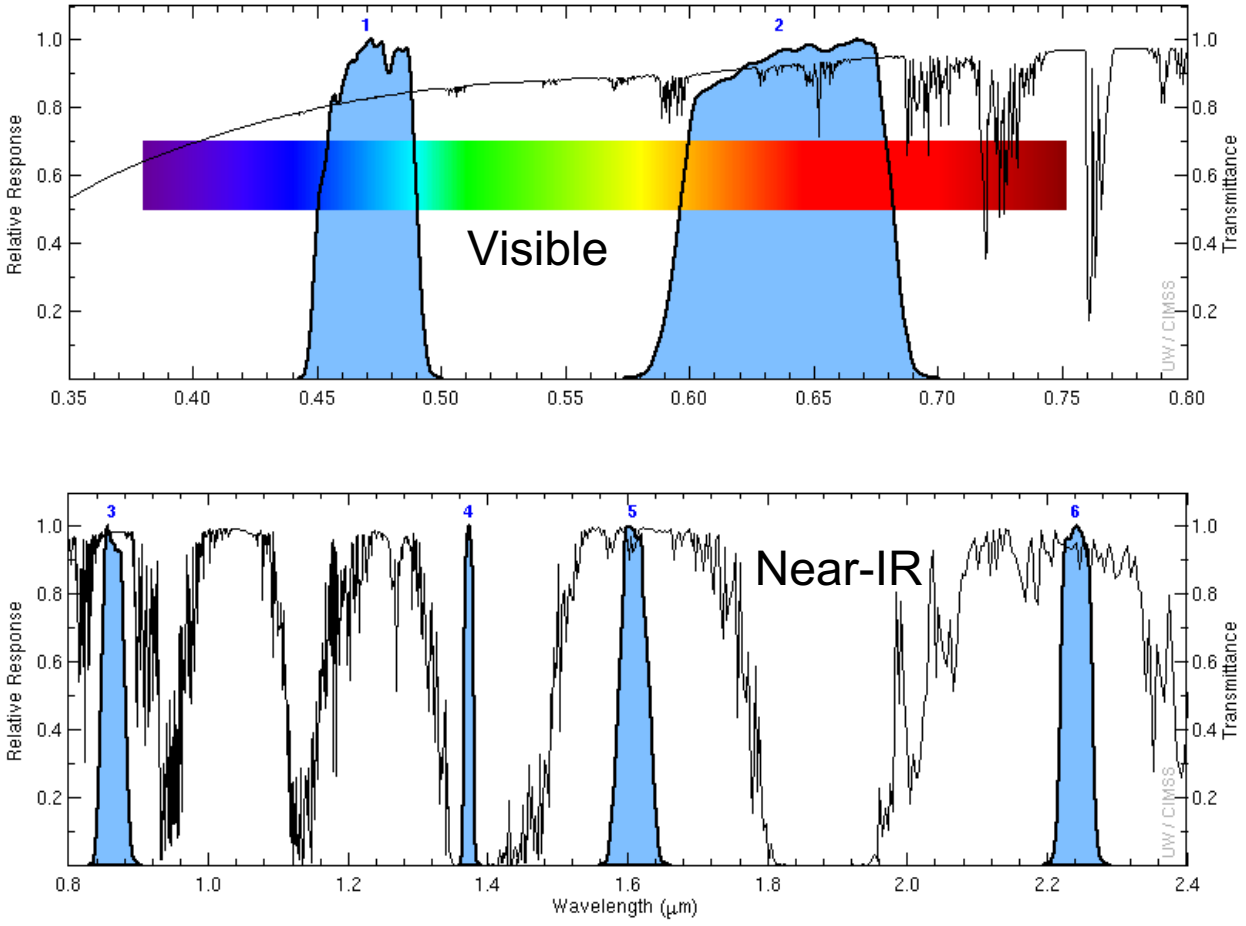


ABI: Bands 1-6 (Visible / NearIR)

ABI Band	Wavelength (µm)	Wavelength range (µm)	Sub-point pixel spacing (km)	Descriptive Name
1	0.47	0.45 - 0.49	1	“Blue”
2	0.64	0.60 - 0.68	0.5	“Red”
3	0.864	0.847 - 0.882	1	“Veggie”
4	1.373	1.366 - 1.380	2	“Cirrus”
5	1.61	1.59 - 1.63	1	“Snow/Ice”
6	2.24	2.22 -2.27	2	“Cloud Particle Size”

Six visible or near visible bands on ABI, one on heritage imager

ABI Spectral (Vis and near-IR) Bands

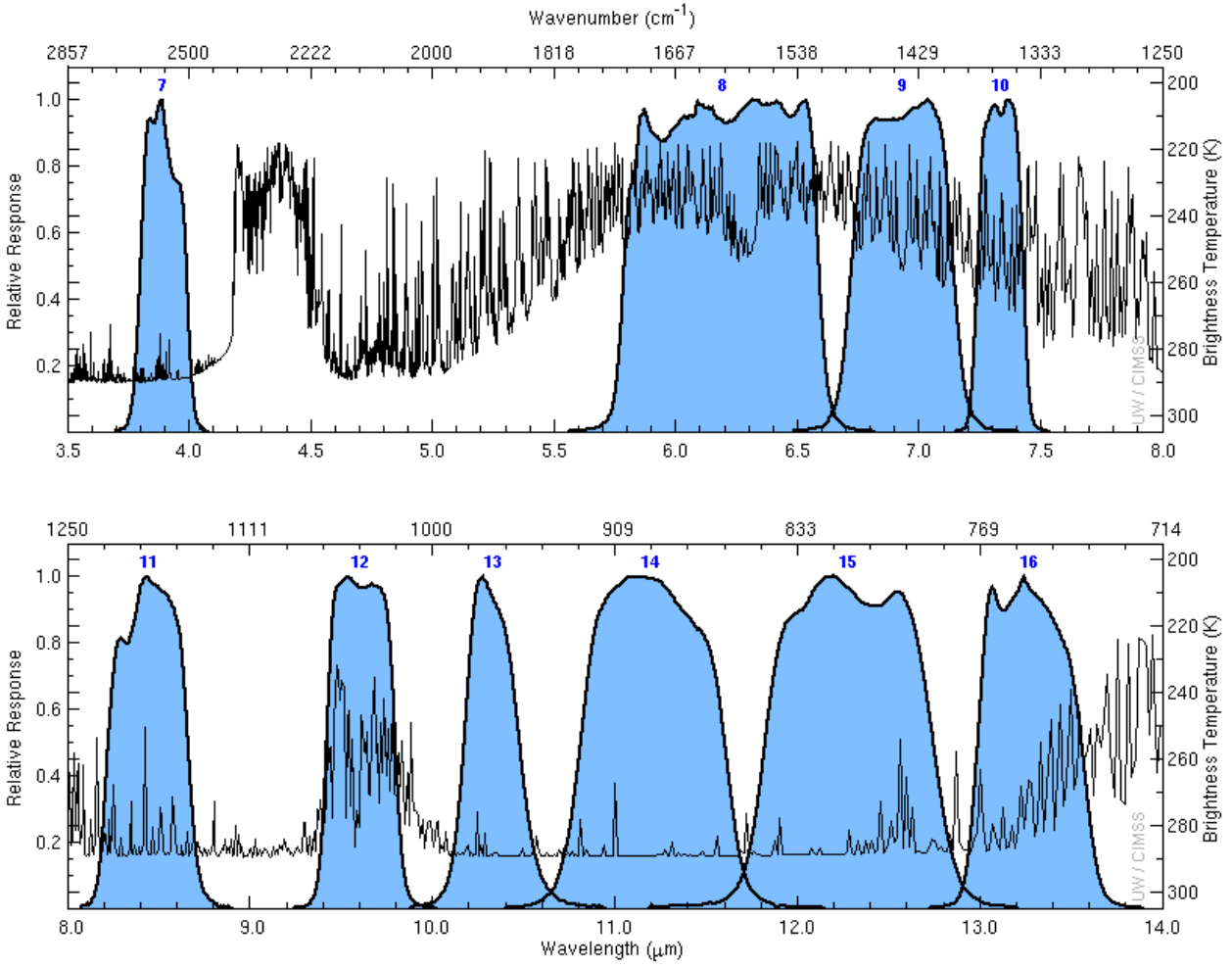


ABI: Bands 7-16 (Infrared)

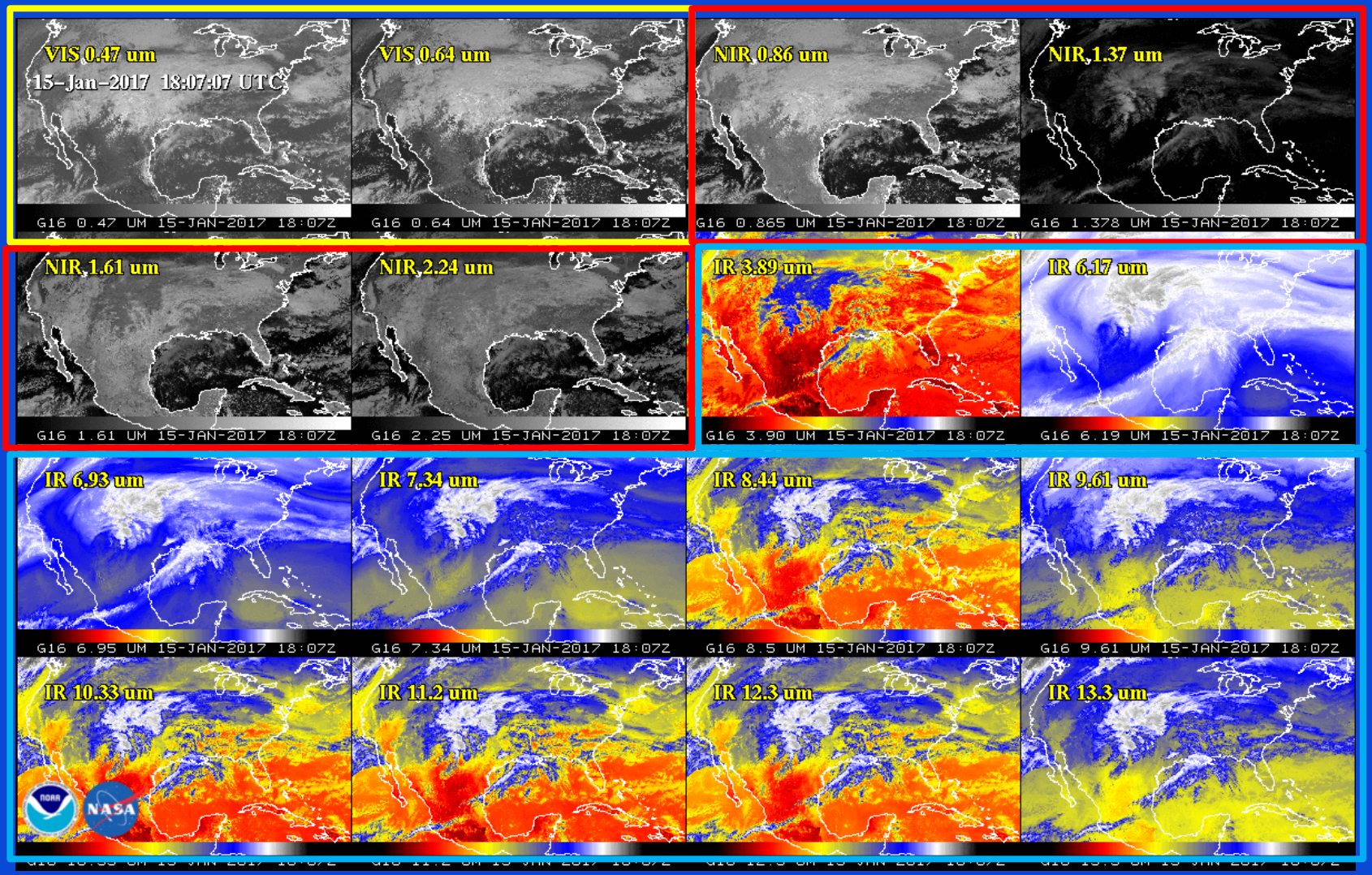
ABI Band	Wavelength (μm)	Wavelength range (μm)	Sub-point pixel spacing (km)	Descriptive Name
7	3.90	3.80 - 3.99	2	“Shortwave window”
8	6.19	5.79 - 6.59	2	“Upper-level Water Vapor”
9	6.93	6.72 - 7.14	2	“Mid-Level Water Vapor”
10	7.34	7.24 - 7.43	2	“Lower/Mid-level Water Vapor”
11	8.44	8.23 - 8.66	2	“Cloud-top Phase”
12	9.61	9.42 - 9.80	2	“Ozone”
13	10.33	10.18 - 10.48	2	“Clean longwave window”
14	11.21	10.82 - 11.60	2	“Longwave window”
15	12.29	11.83 - 12.75	2	“Dirty longwave window”
16	13.28	12.99 - 13.56	2	“CO_2”

10 infrared bands on the ABI, four on heritage imager

ABI Spectral (IR) Bands

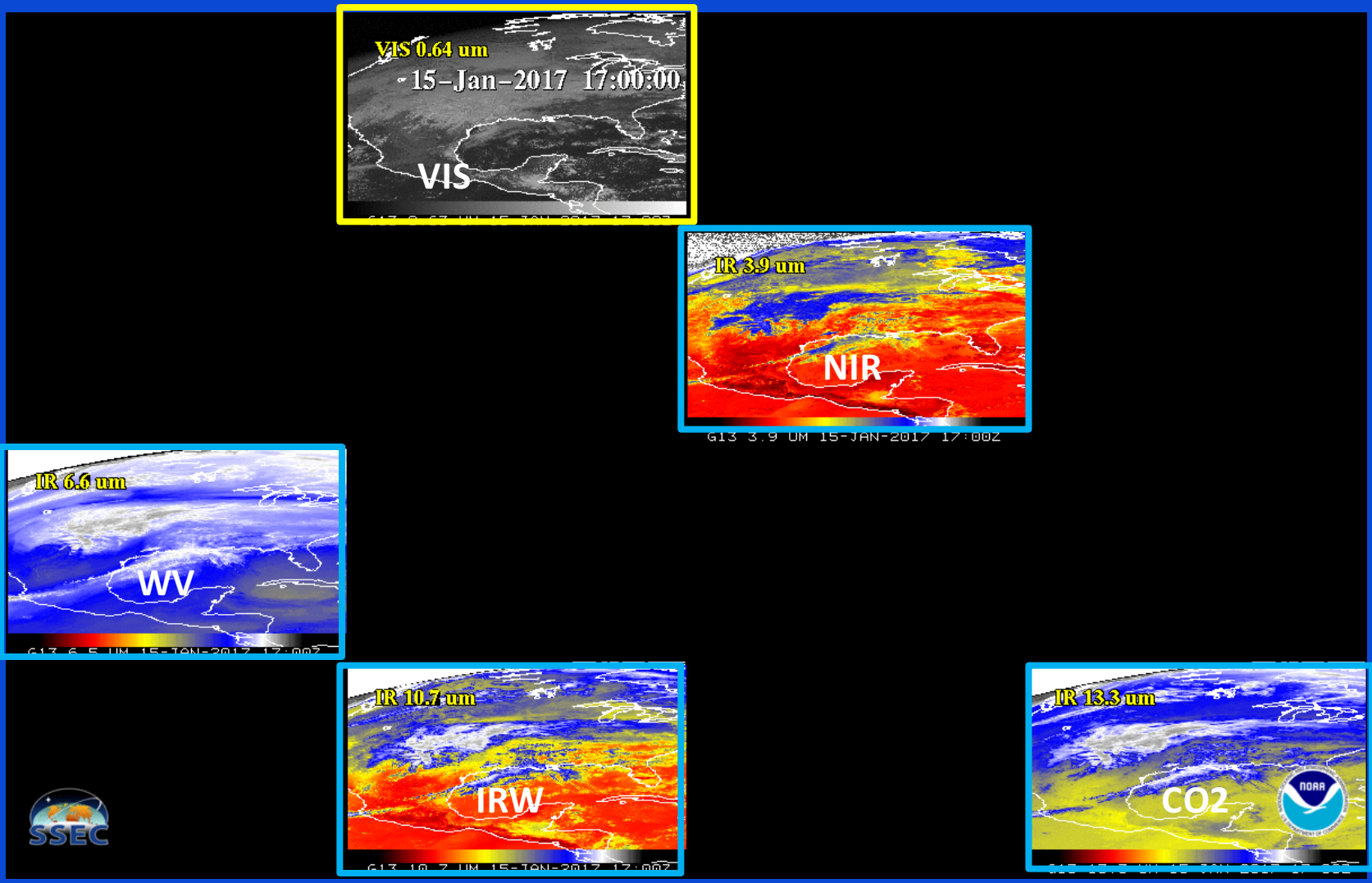


ABI GOES-16 Spectral Bands (16)



2 VIS
4 NIR
10 IR

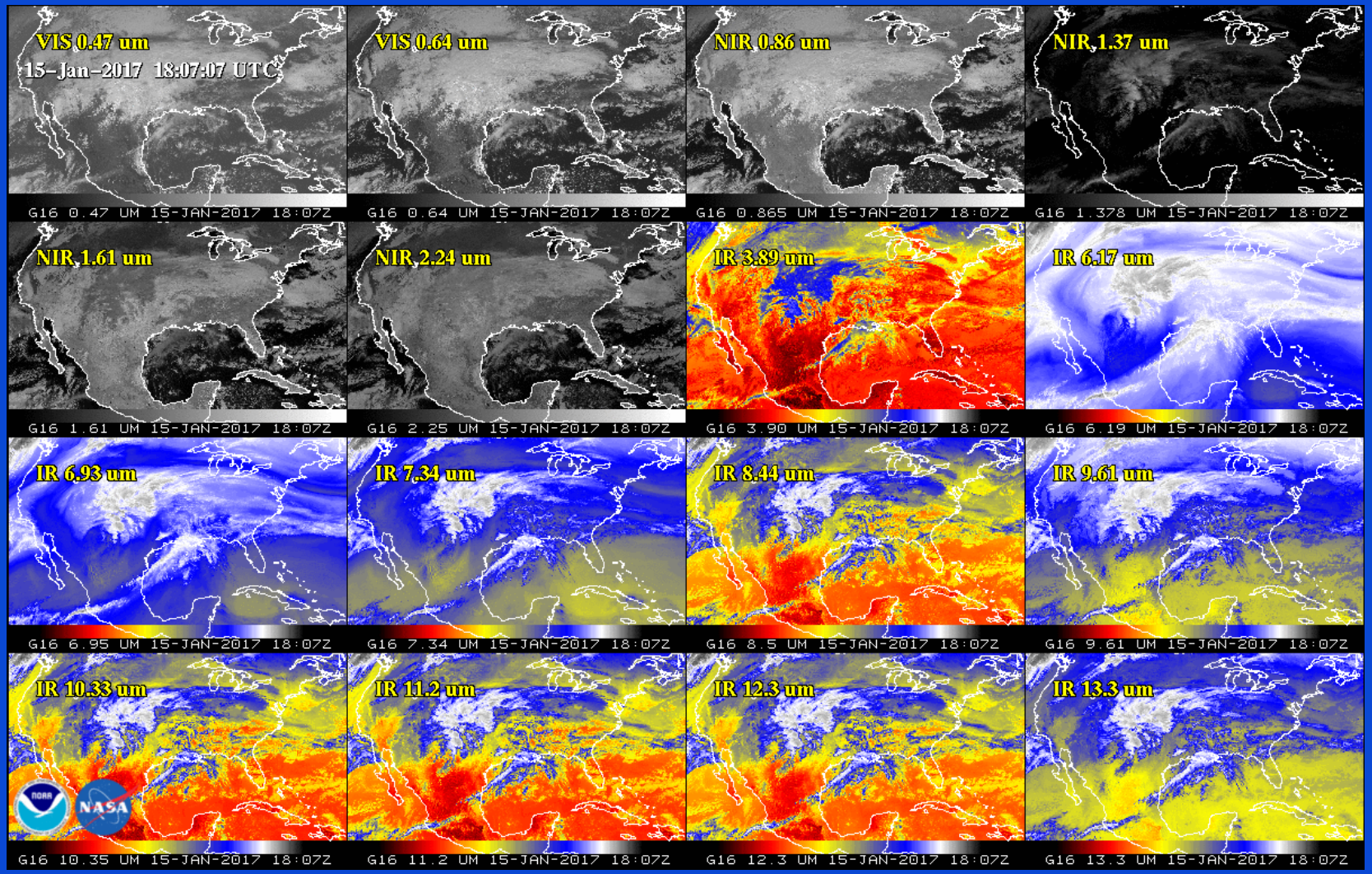
Current GOES Spectral Bands (5)



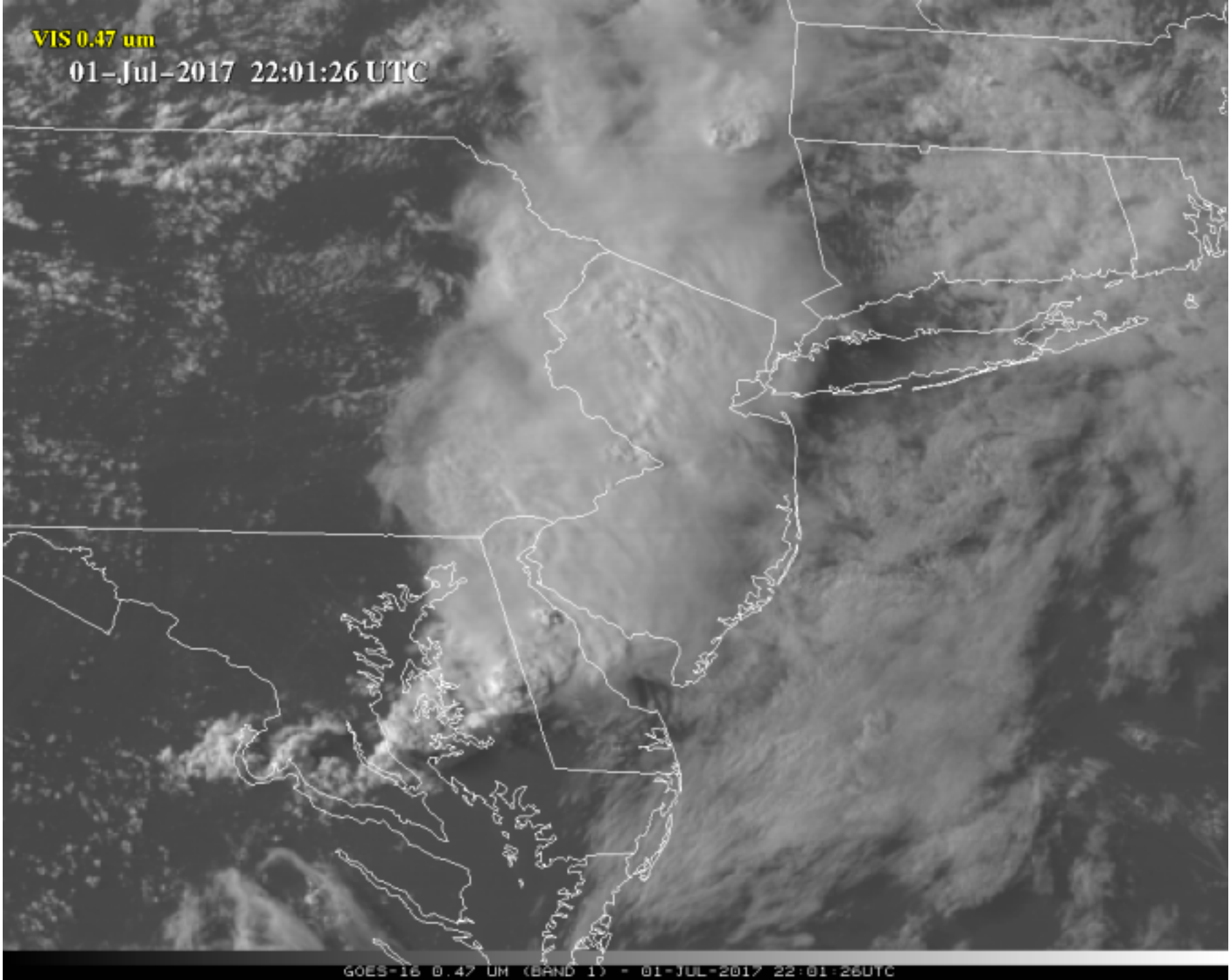
1 VIS
0 NIR
4 IR

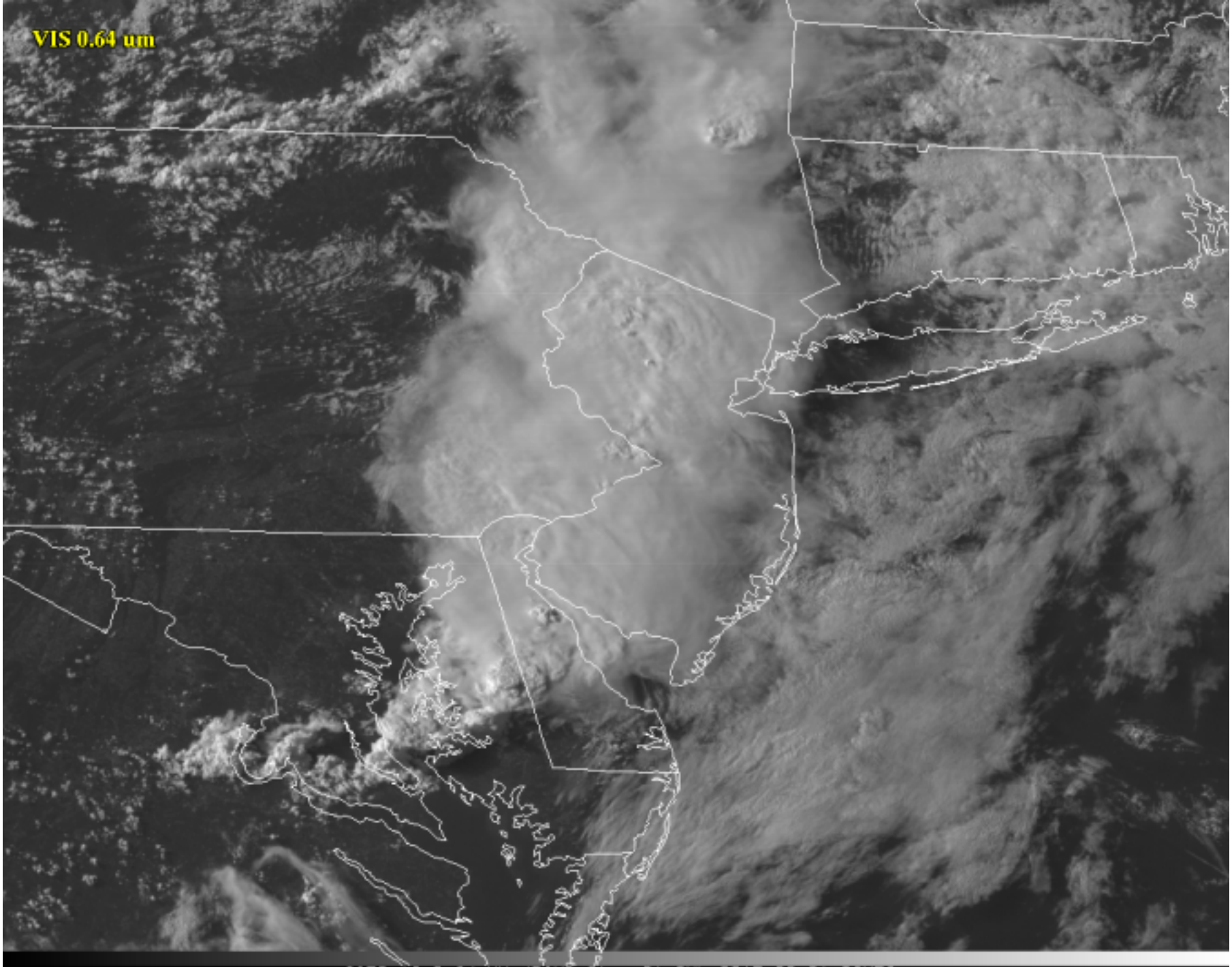
GOES-East

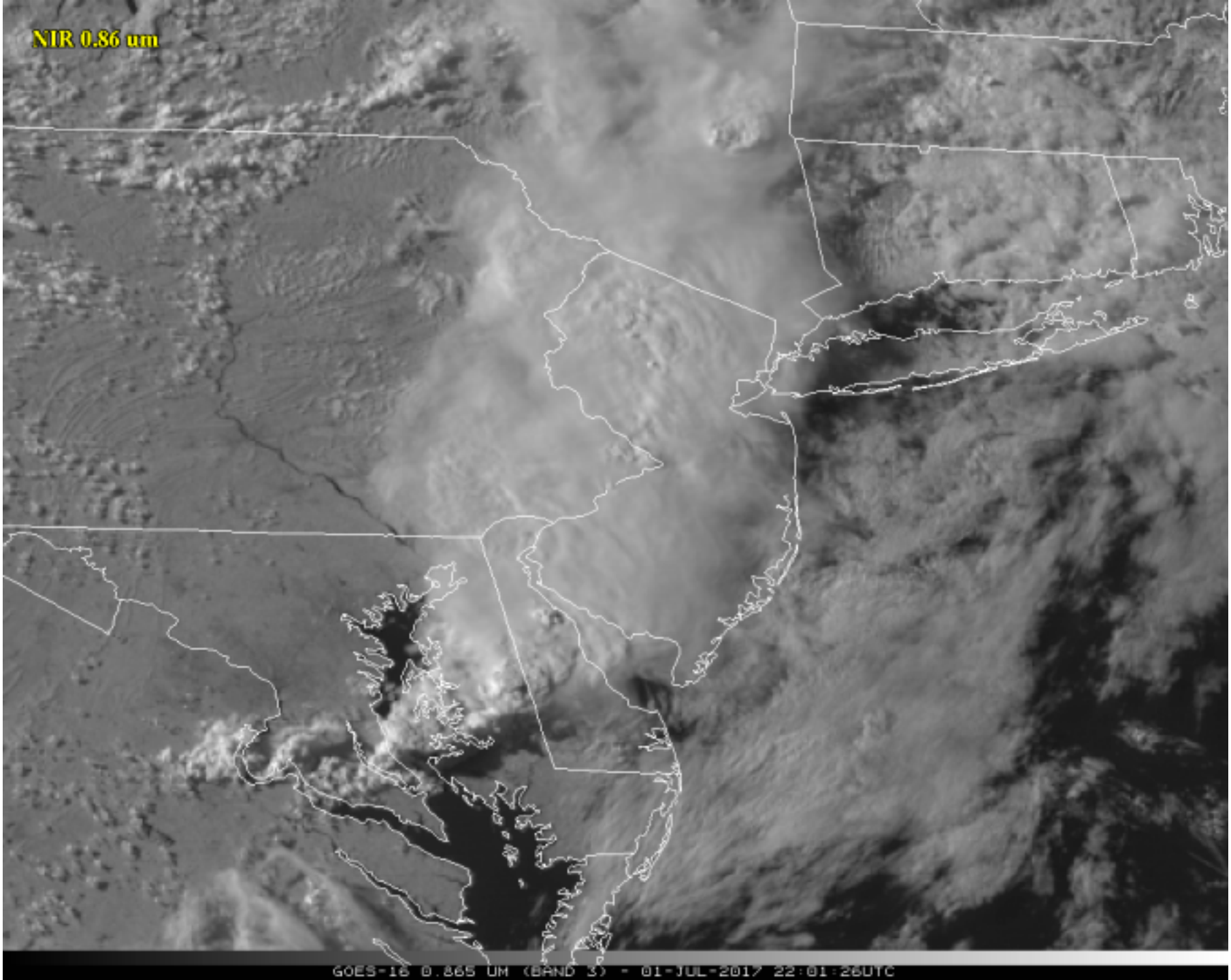
ABI Spectral Bands (16)

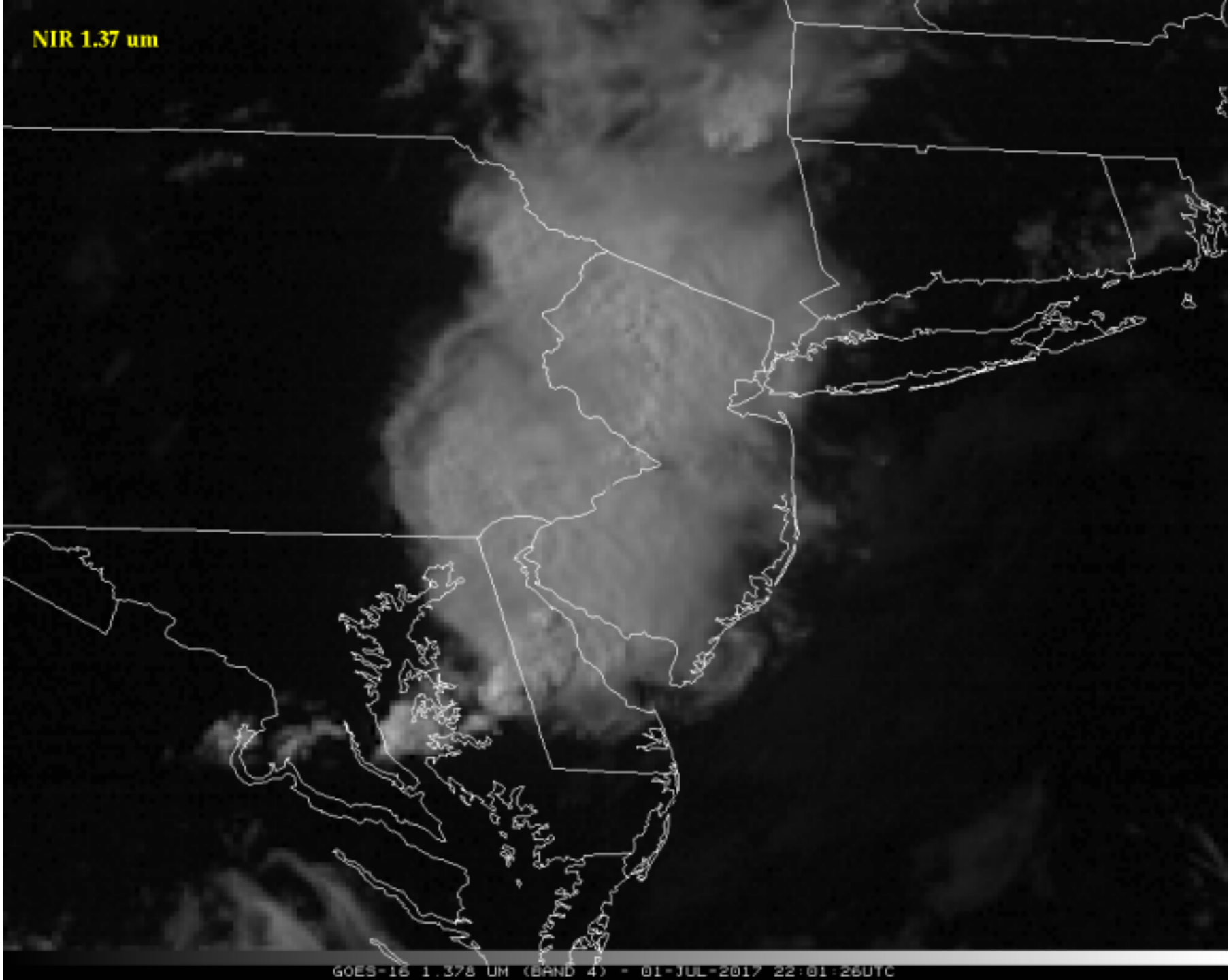


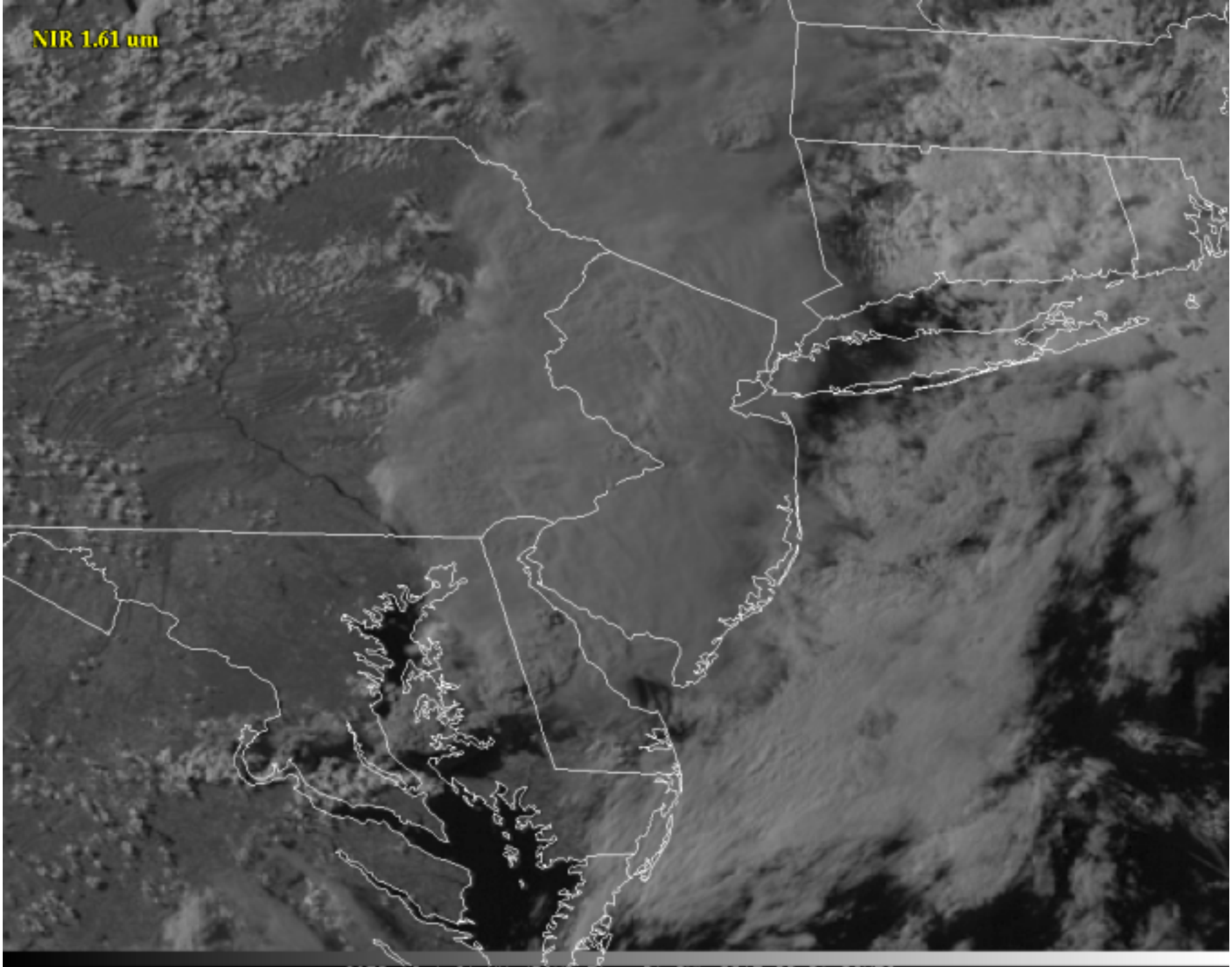
2 VIS
4 NIR
10 IR

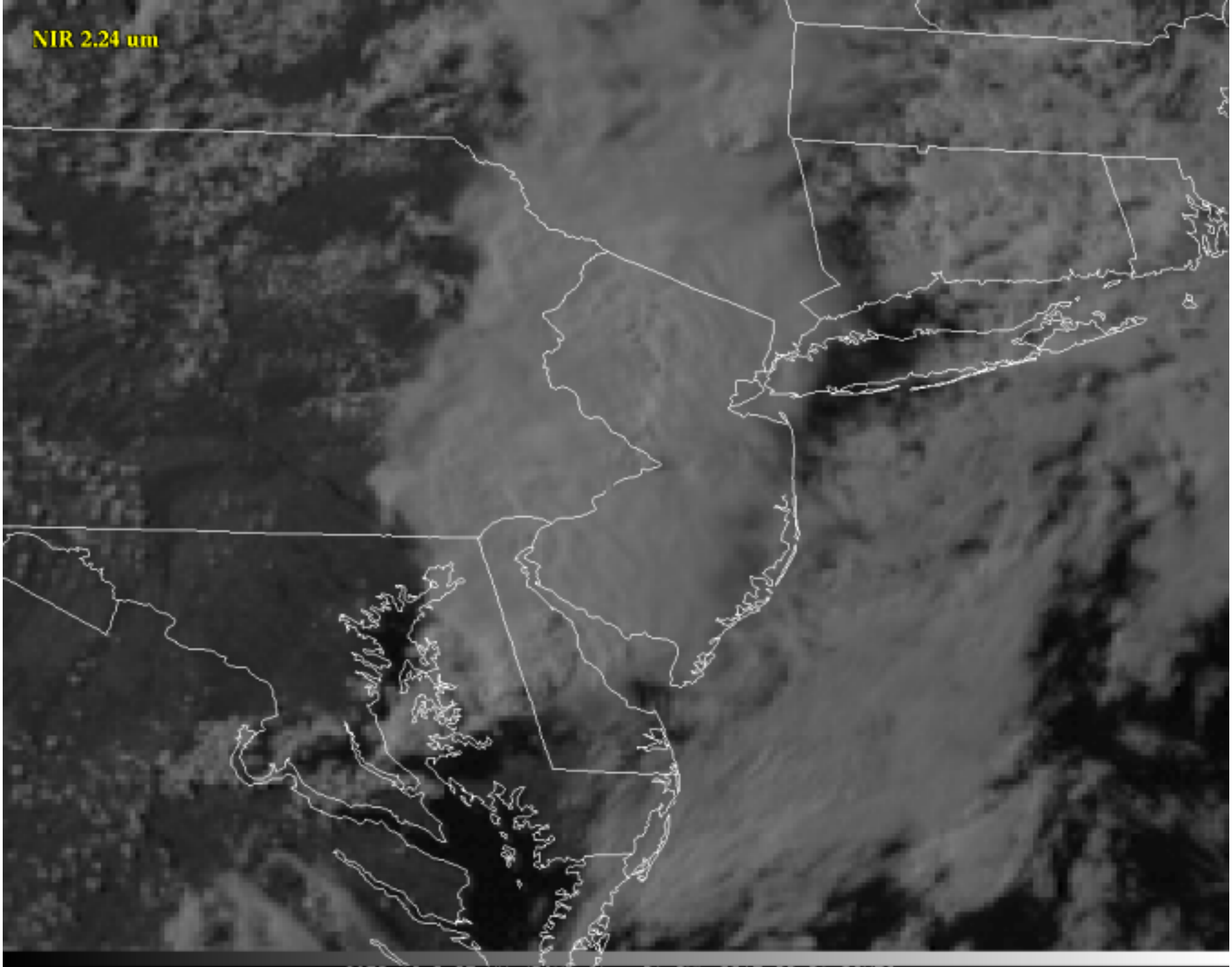

VIS 0.47 um
01-Jul-2017 22:01:26 UTC
GOES-16 0.47 UM (BAND 1) - 01-JUL-2017 22:01:26UTC

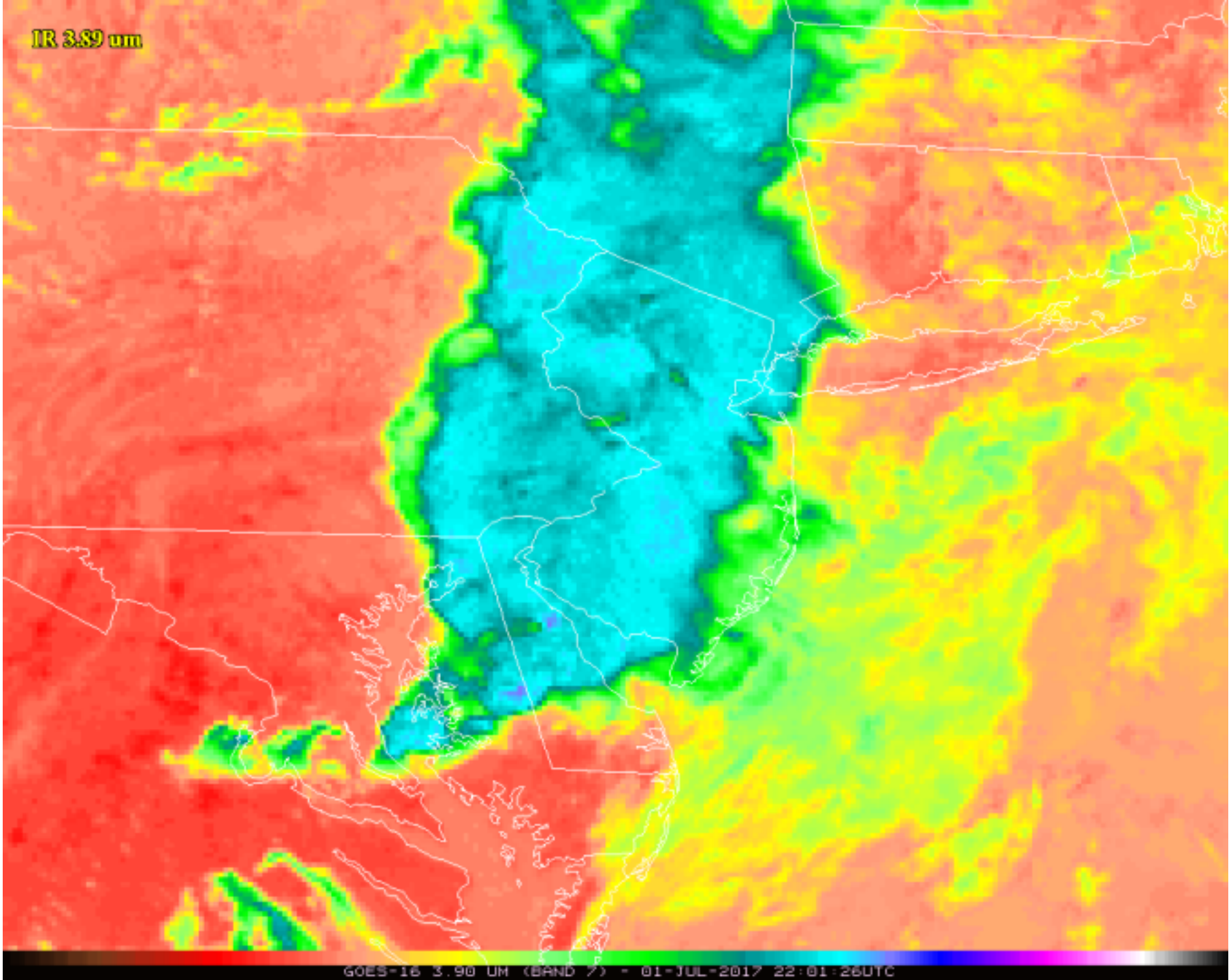

VIS 0.64 um
GOES-16 0.64 UM (BAND 2) - 01-JUL-2017 22:01:26UTC

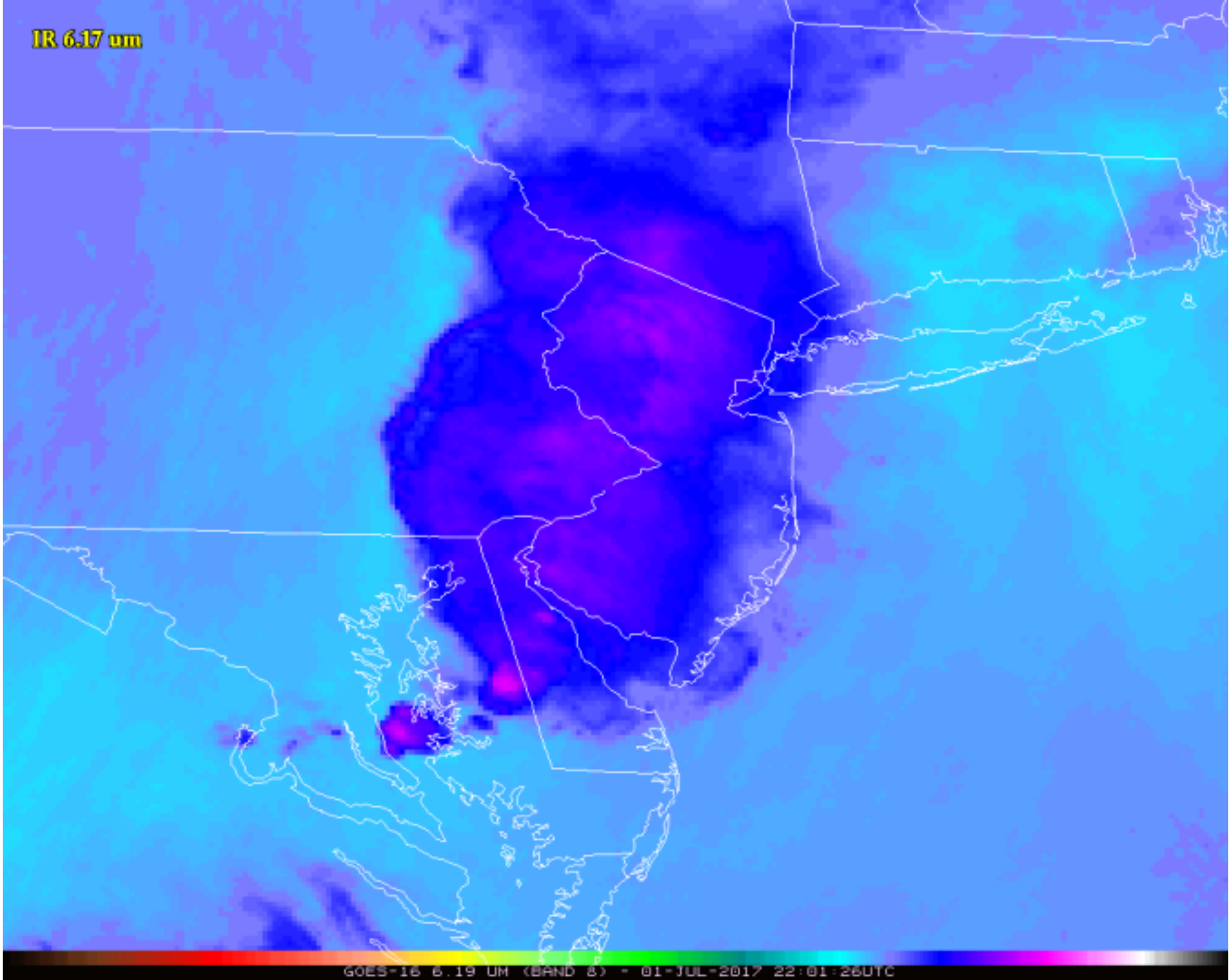

NIR 0.86 um
GOES-16 0.865 UM (BAND 3) - 01-JUL-2017 22:01:26UTC

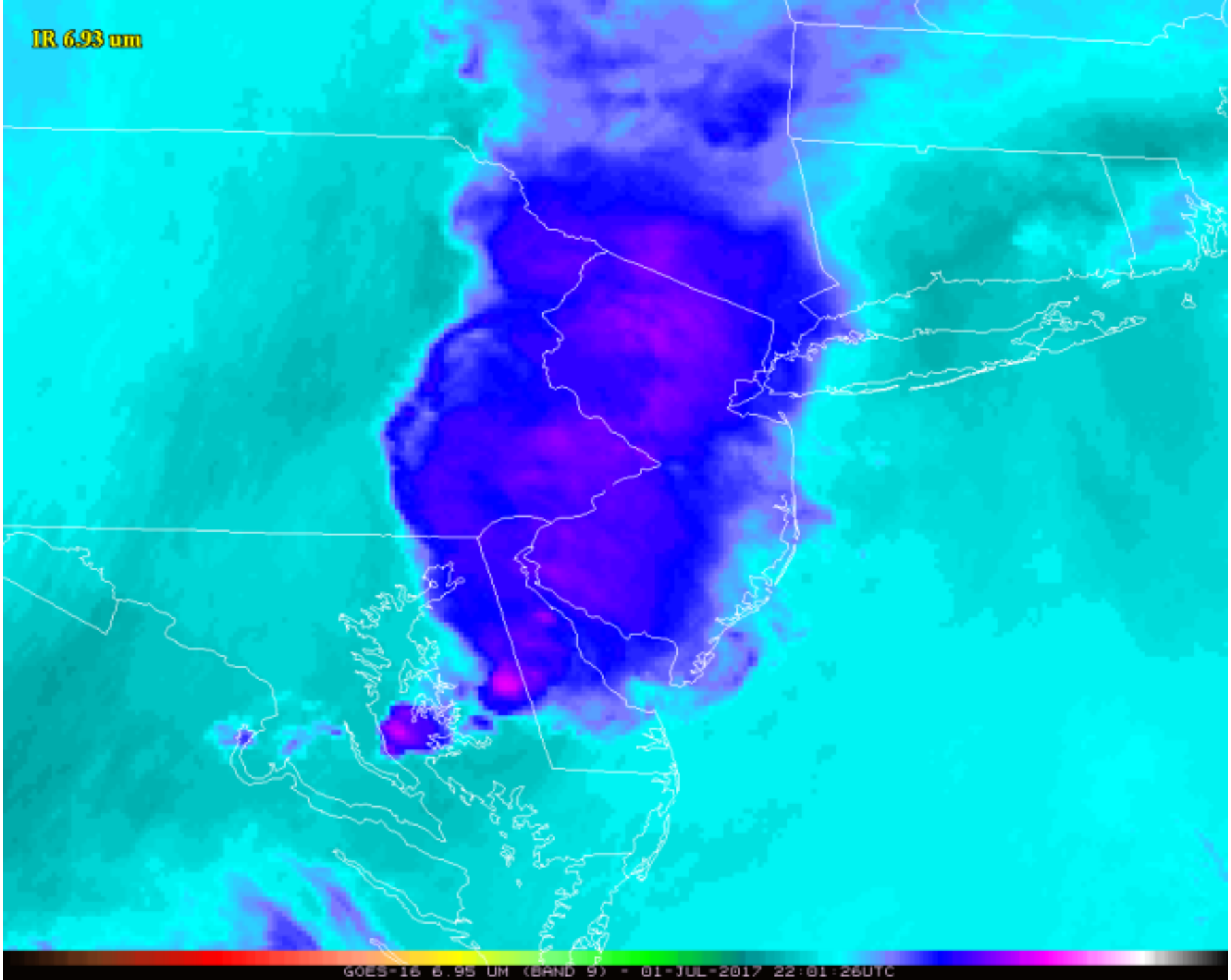

NIR 1.37 um
GOES-16 1.378 UM (BAND 4) - 01-JUL-2017 22:01:26UTC

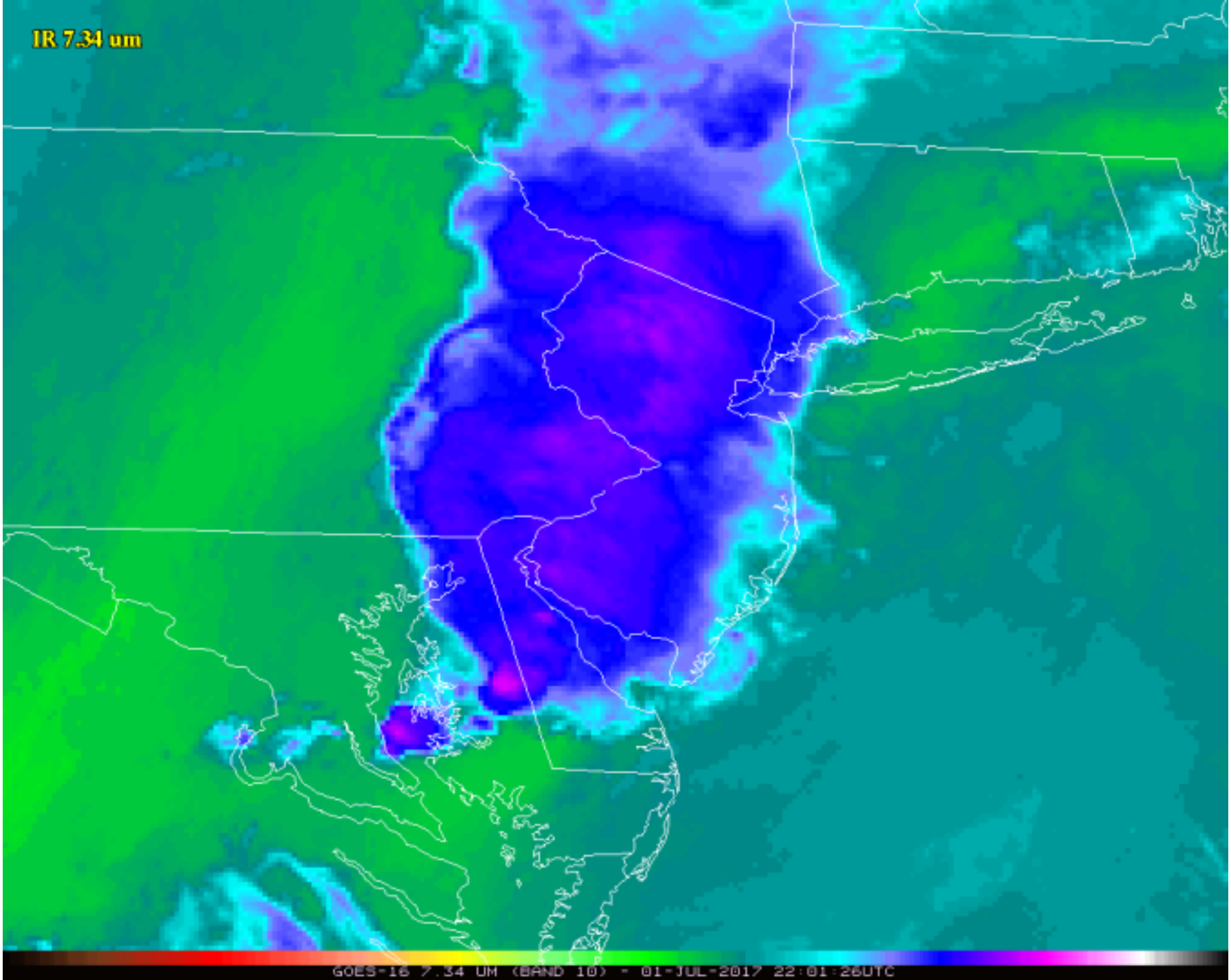

NIR 1.61 um
GOES-16 1.61 UM (BAND 5) - 01-JUL-2017 22:01:26UTC

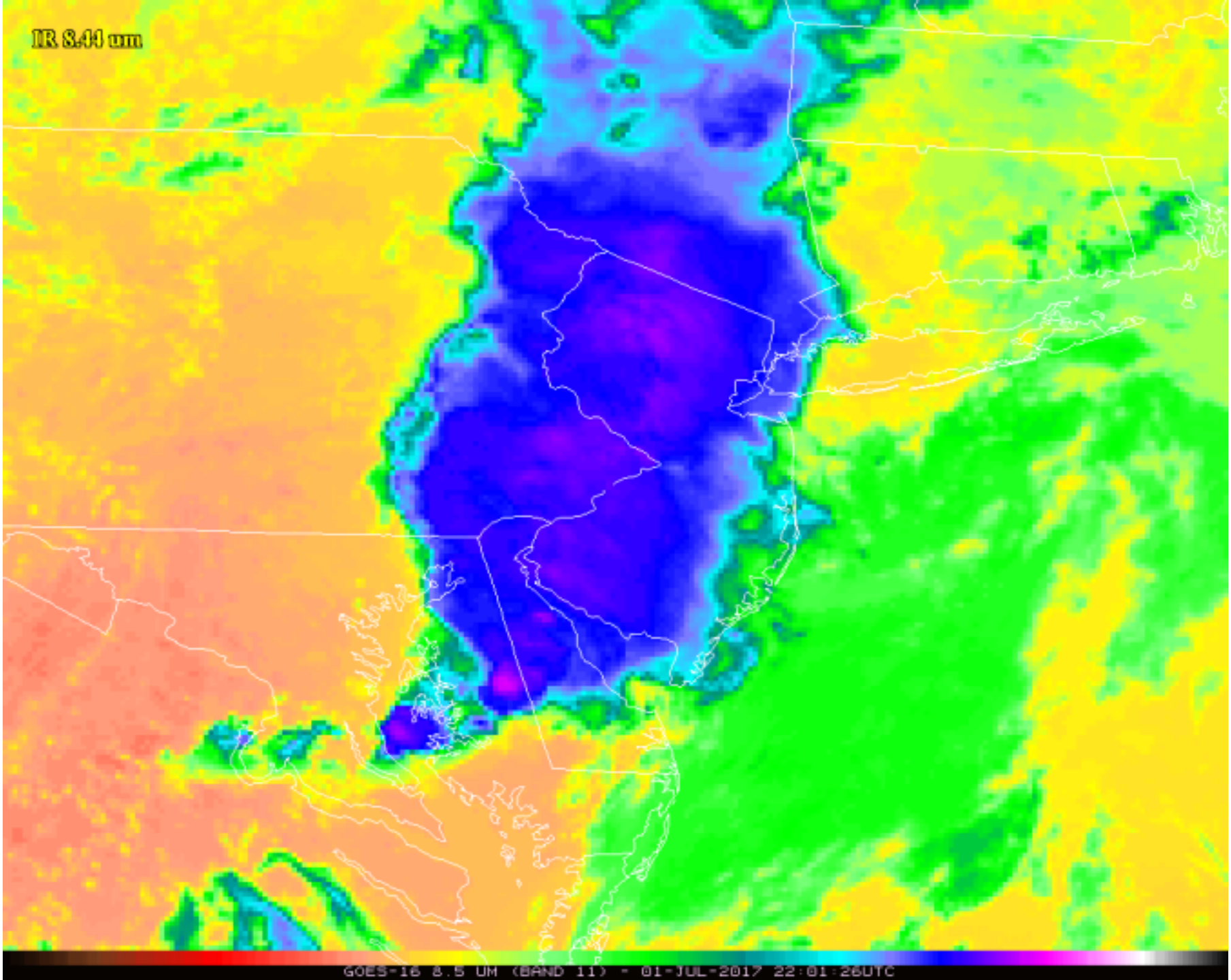

NIR 2.24 um
GOES-16 2.25 UM (BAND 6) - 01-JUL-2017 22:01:26UTC

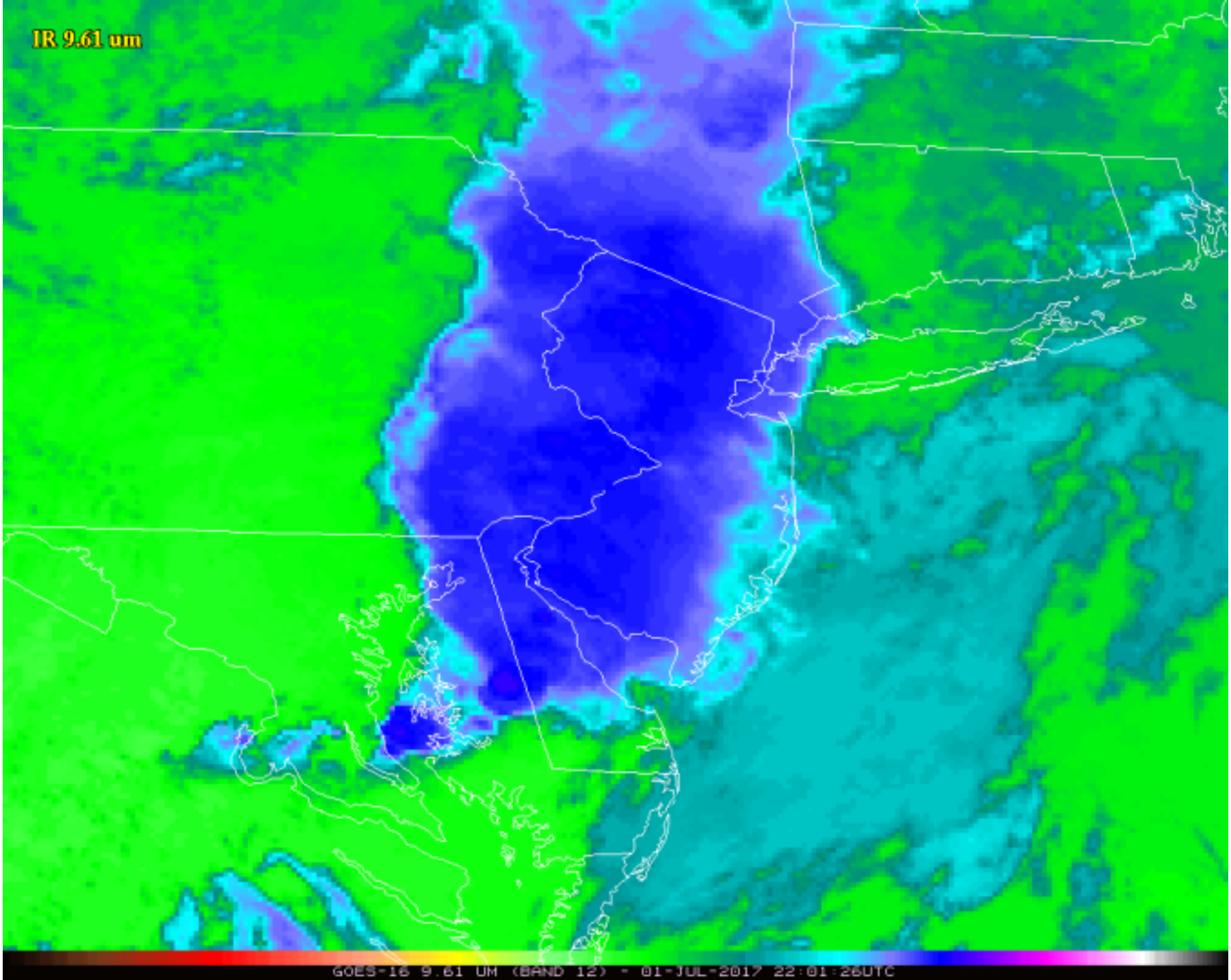

IR 3.89 um
GOES-16 3.90 UM (BAND 7) - 01-JUL-2017 22:01:26UTC

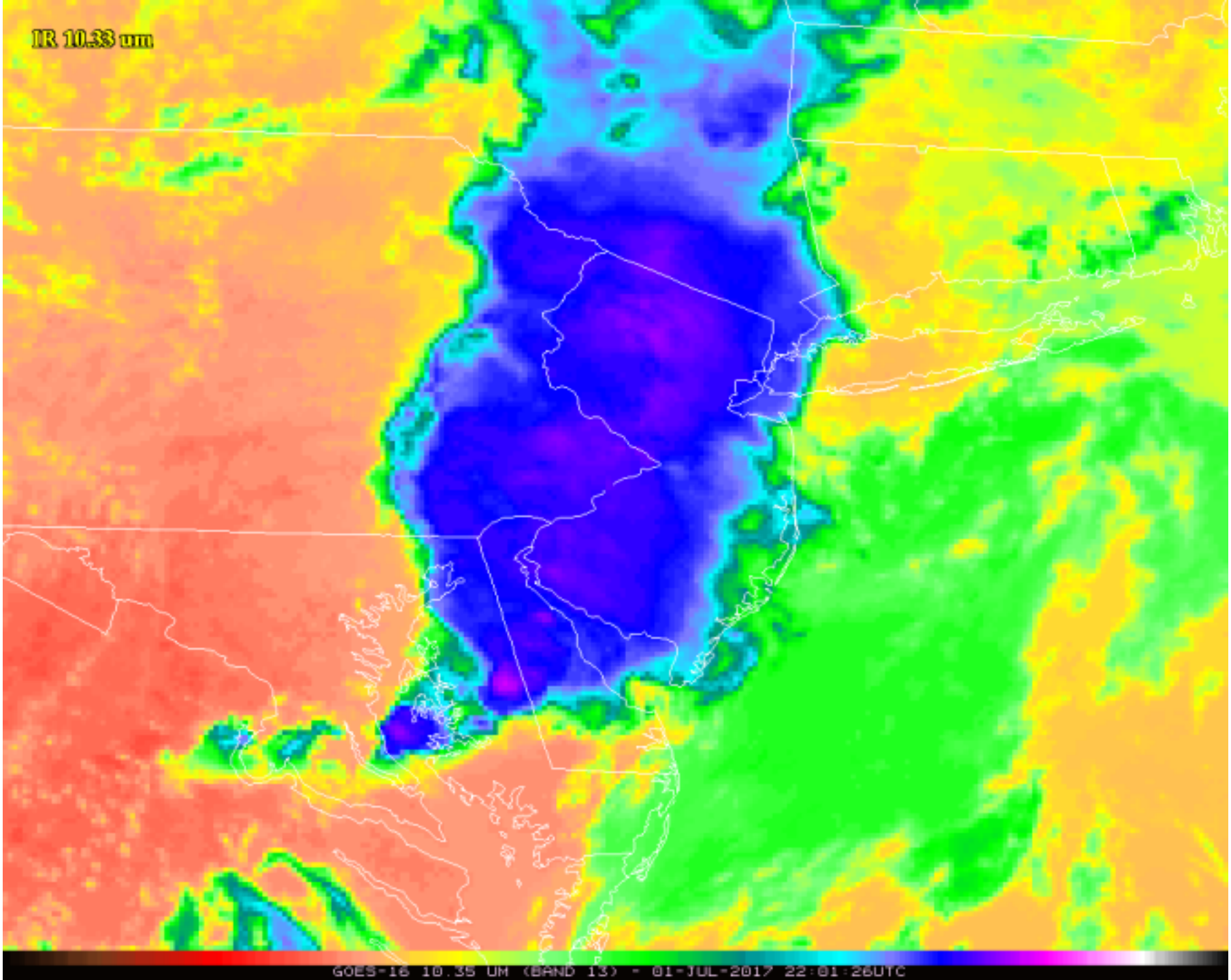

IR 6.17 um
GOES-16 6.19 UM (BAND 8) - 01-JUL-2017 22:01:26UTC

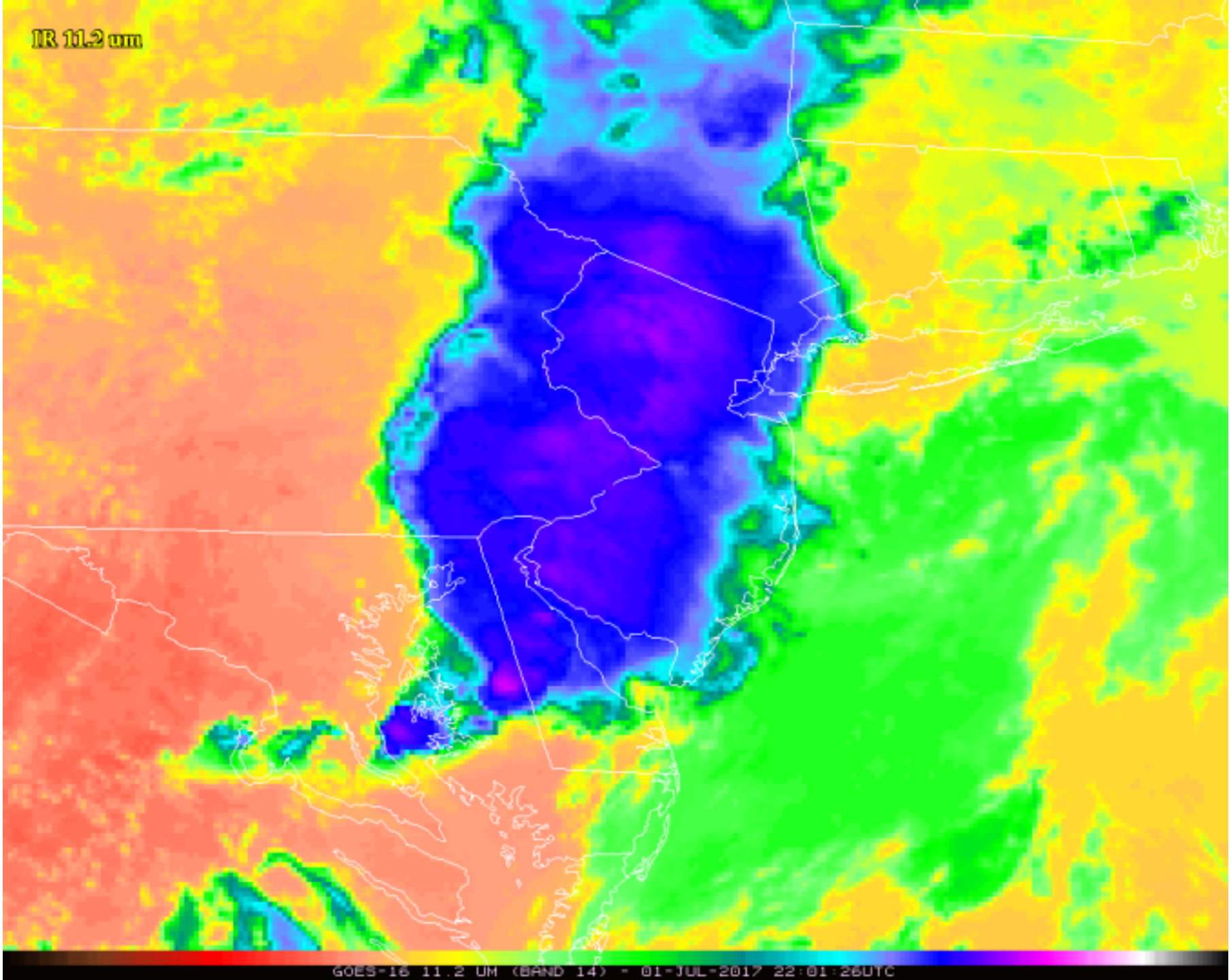

IR 6.93 um
GOES-16 6.95 UM (BAND 9) - 01-JUL-2017 22:01:26UTC

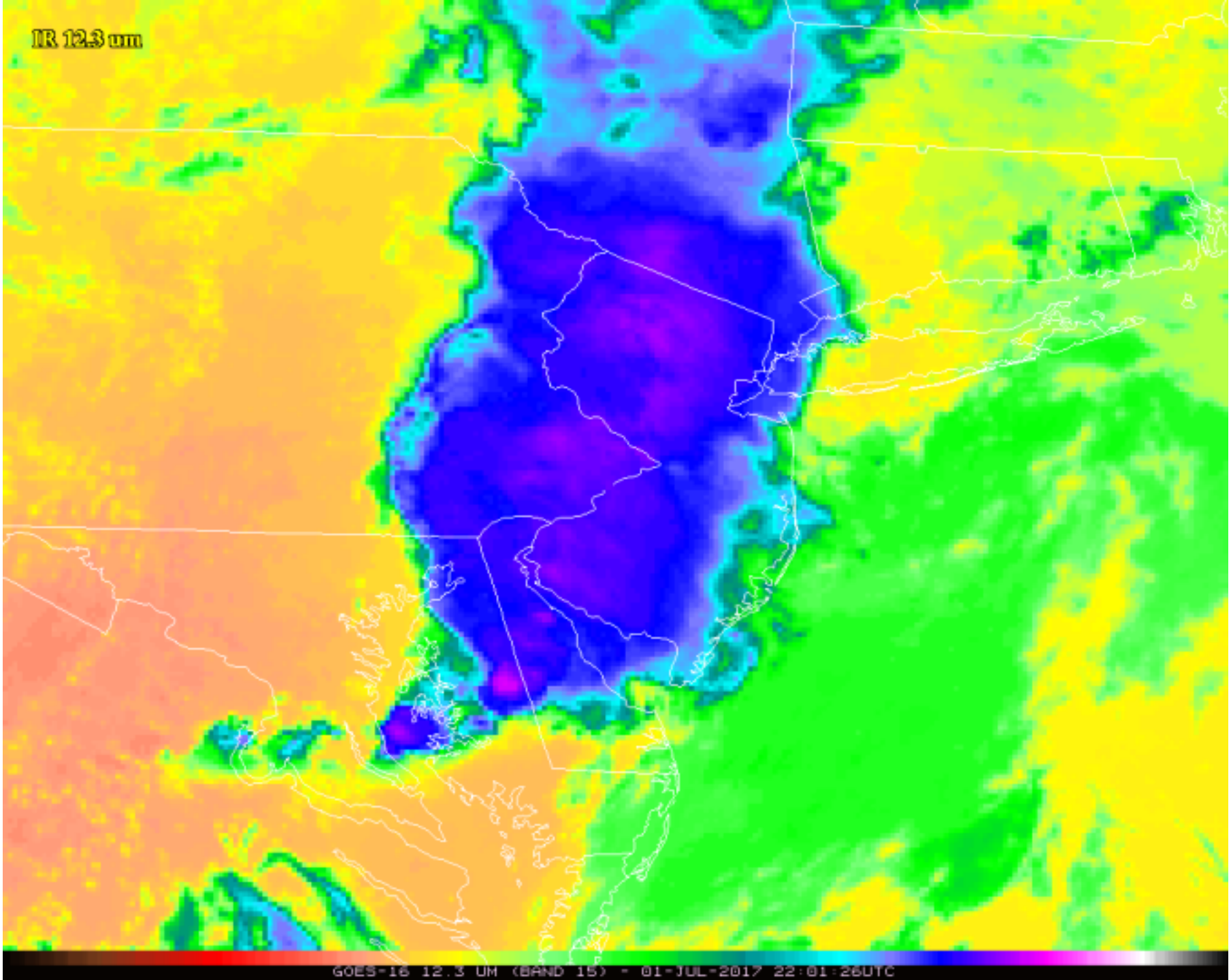

IR 7.34 um
GOES-16 7.34 UM (BAND 10) - 01-JUL-2017 22:01:26UTC

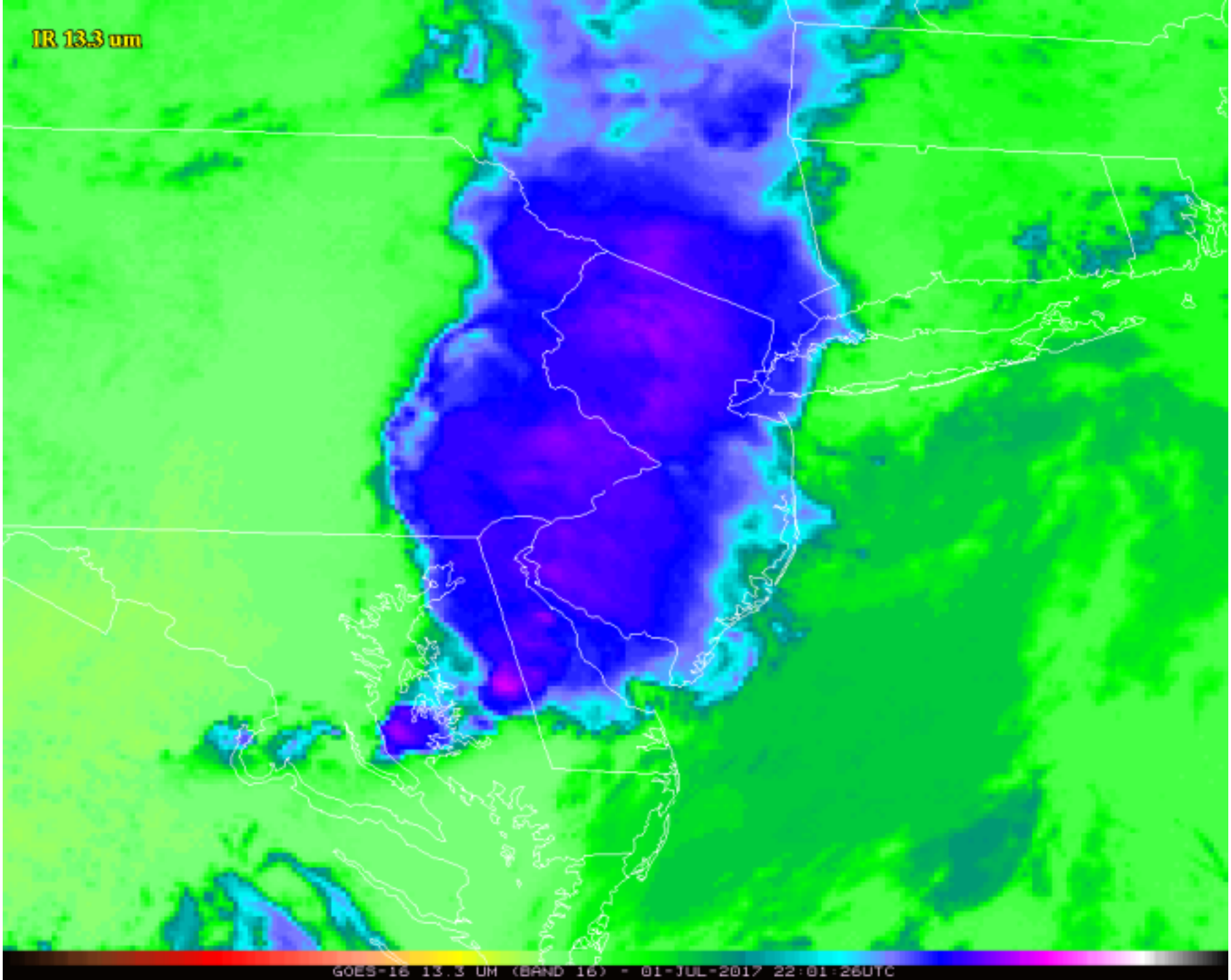

IR 8.44 um
GOES-16 8.5 UM (BAND 11) - 01-JUL-2017 22:01:26UTC

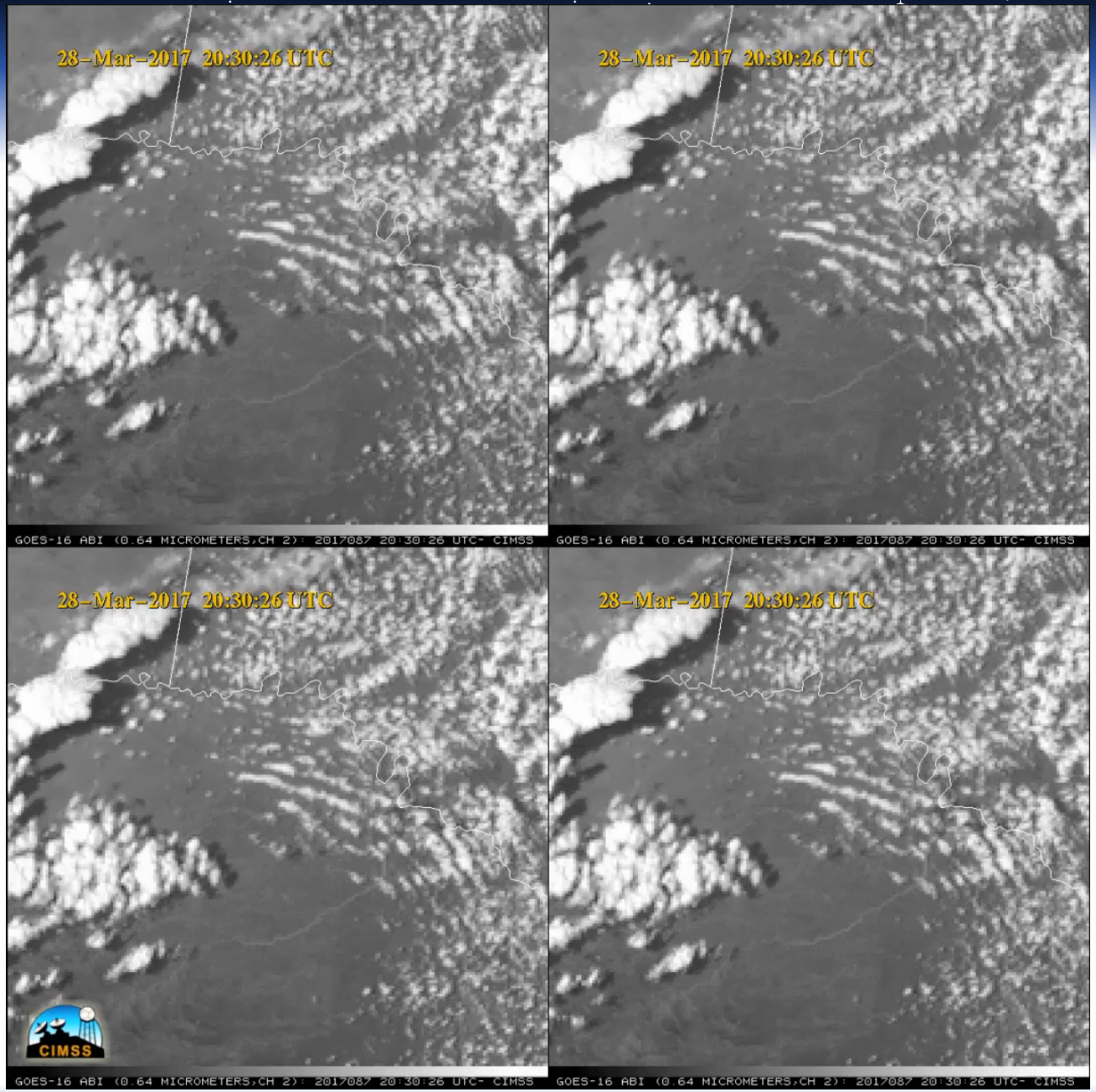

IR 9.61 um
GOES-16 9.61 UM (BAND 12) - 01-JUL-2017 22:01:26UTC


IR 10.33 um
GOES-16 10.35 UM (BAND 13) - 01-JUL-2017 22:01:26UTC

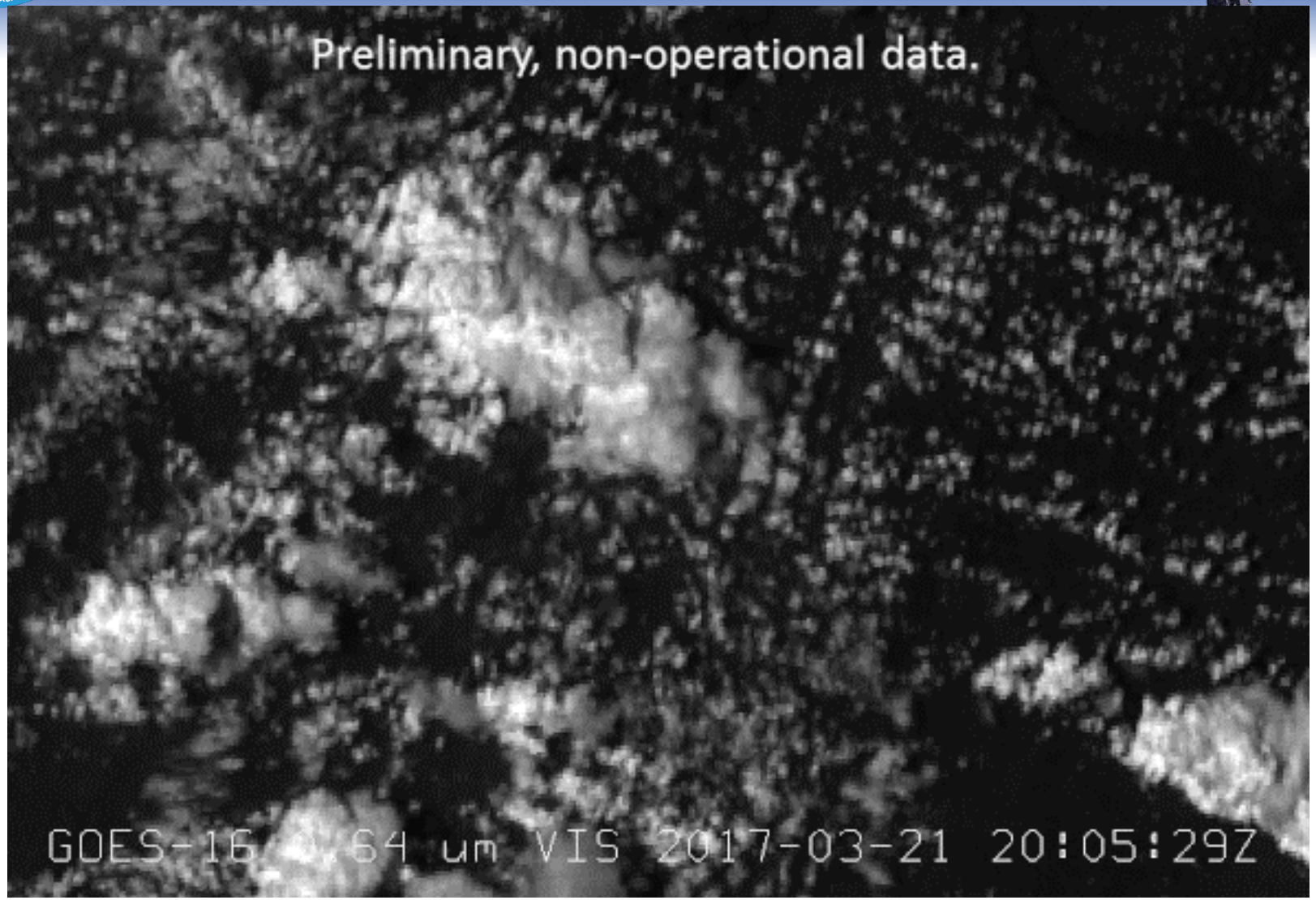

IR 11.2 um
GOES-16 11.2 UM (BAND 14) - 01-JUL-2017 22:01:26UTC


IR 12.3 um
GOES-16 12.3 UM (BAND 15) - 01-JUL-2017 22:01:26UTC


IR 13.3 um
GOES-16 13.3 UM (BAND 16) - 01-JUL-2017 22:01:26UTC

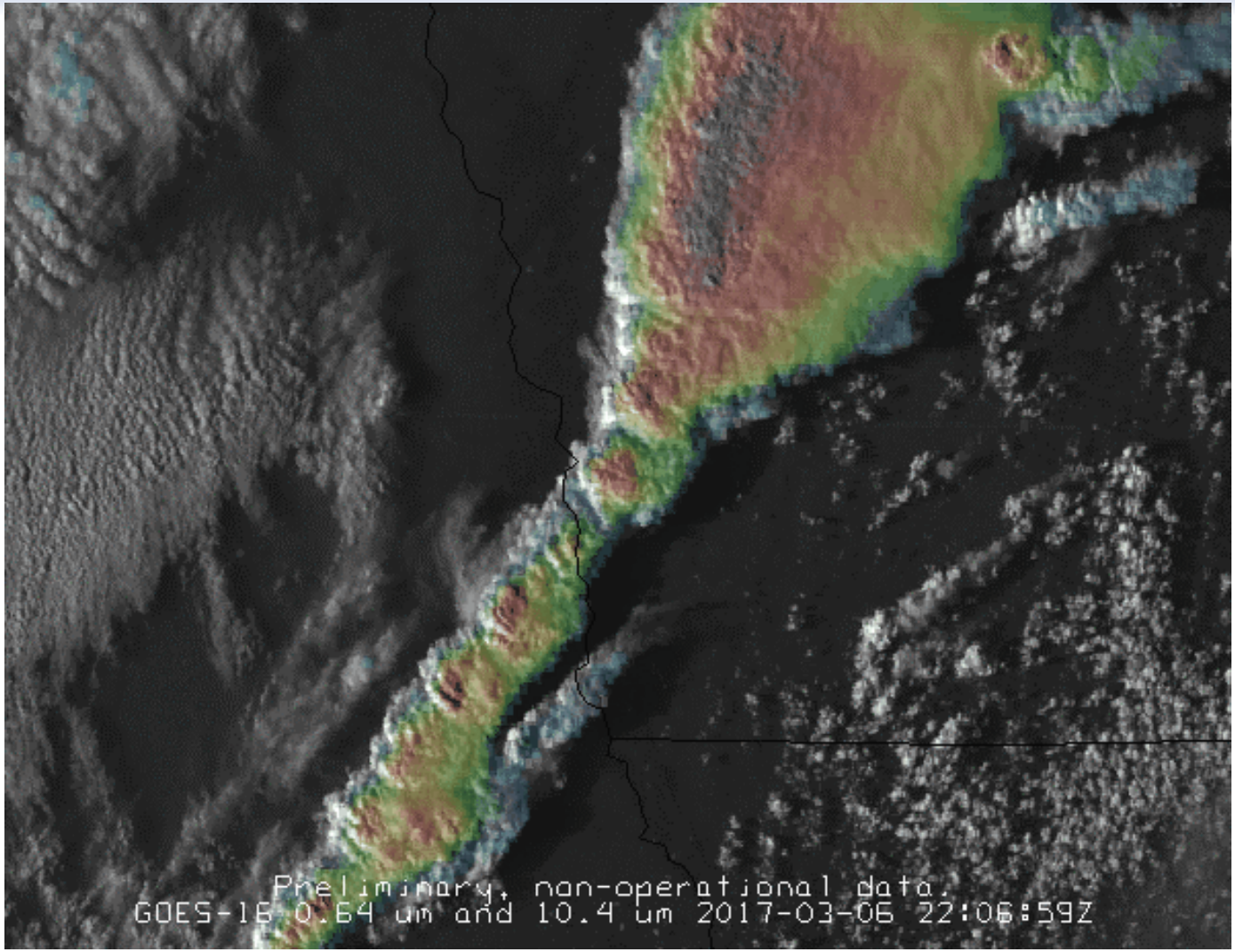

28-Mar-2017 20:30:26 UTC
28-Mar-2017 20:30:26 UTC
28-Mar-2017 20:30:26 UTC
28-Mar-2017 20:30:26 UTC
GOES-16 ABI (0.64 MICROMETERS,CH 2): 2017087 20:30:26 UTC- CIMSS
GOES-16 ABI (0.64 MICROMETERS,CH 2): 2017087 20:30:26 UTC- CIMSS
GOES-16 ABI (0.64 MICROMETERS,CH 2): 2017087 20:30:26 UTC- CIMSS
GOES-16 ABI (0.64 MICROMETERS,CH 2): 2017087 20:30:26 UTC- CIMSS
CIMSS

Convective Initiation



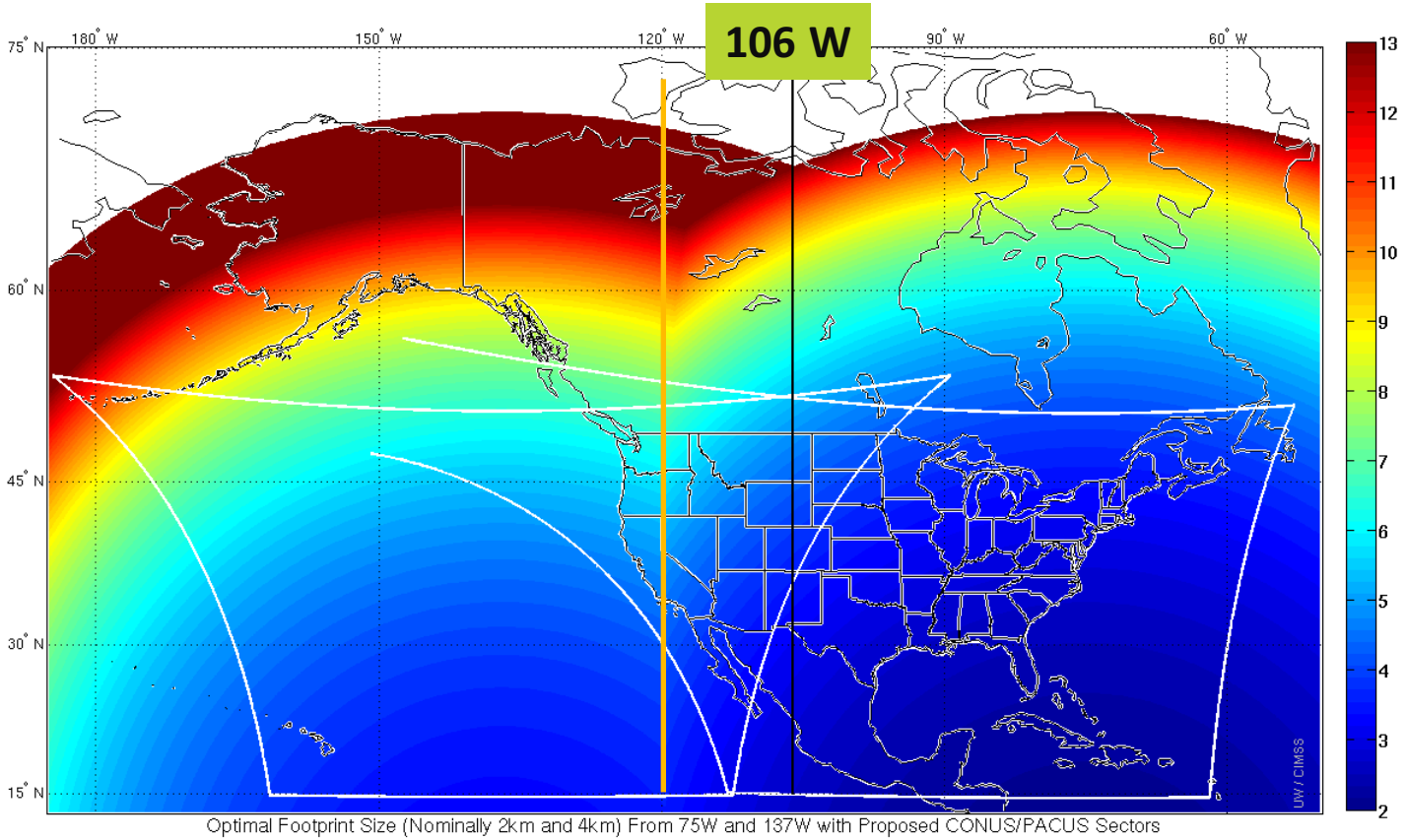
- Visible animation every 30-seconds!

Squall Line



- Visible and infrared

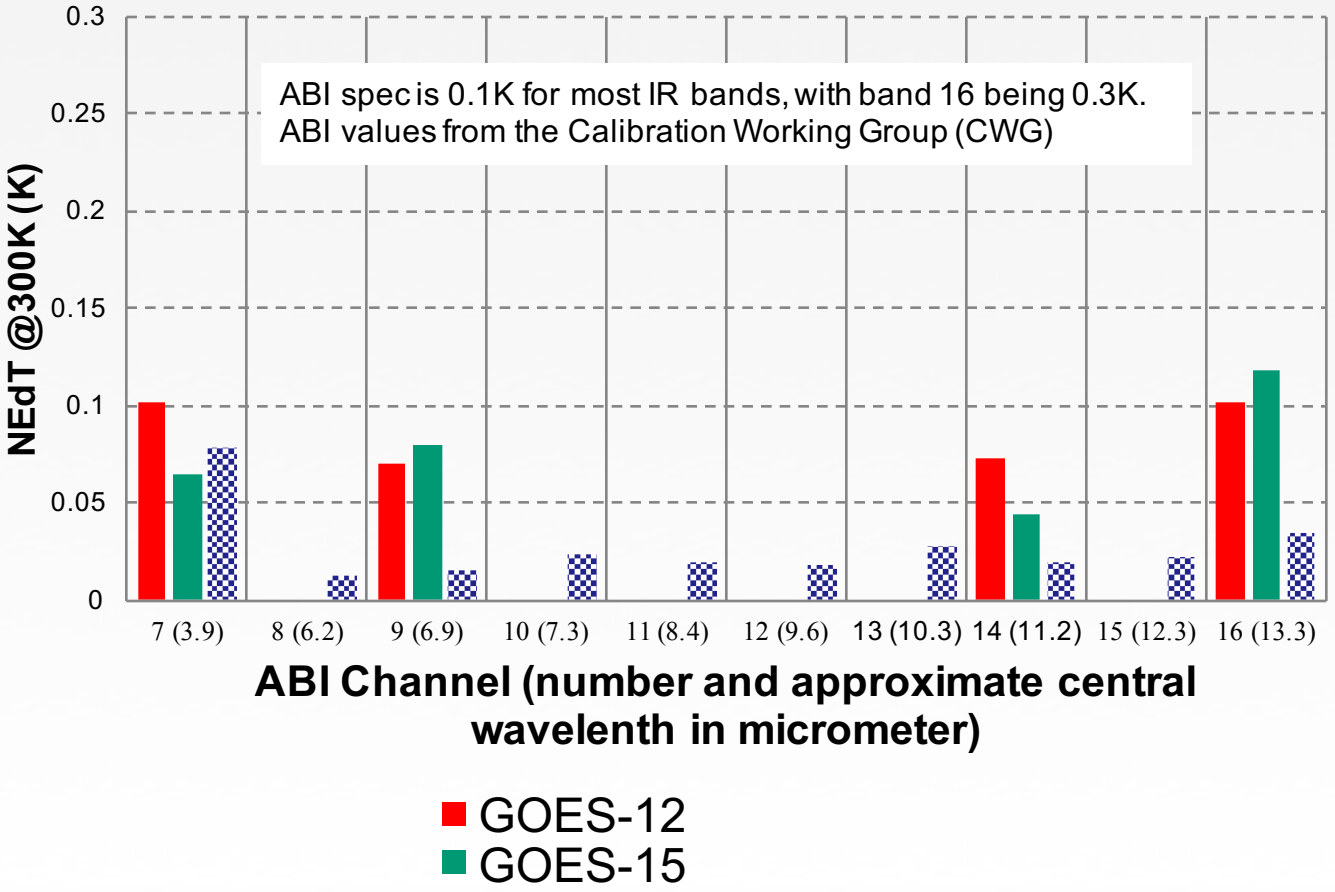
GOES-R (16) as GOES-East
GOES-15 as GOES-West



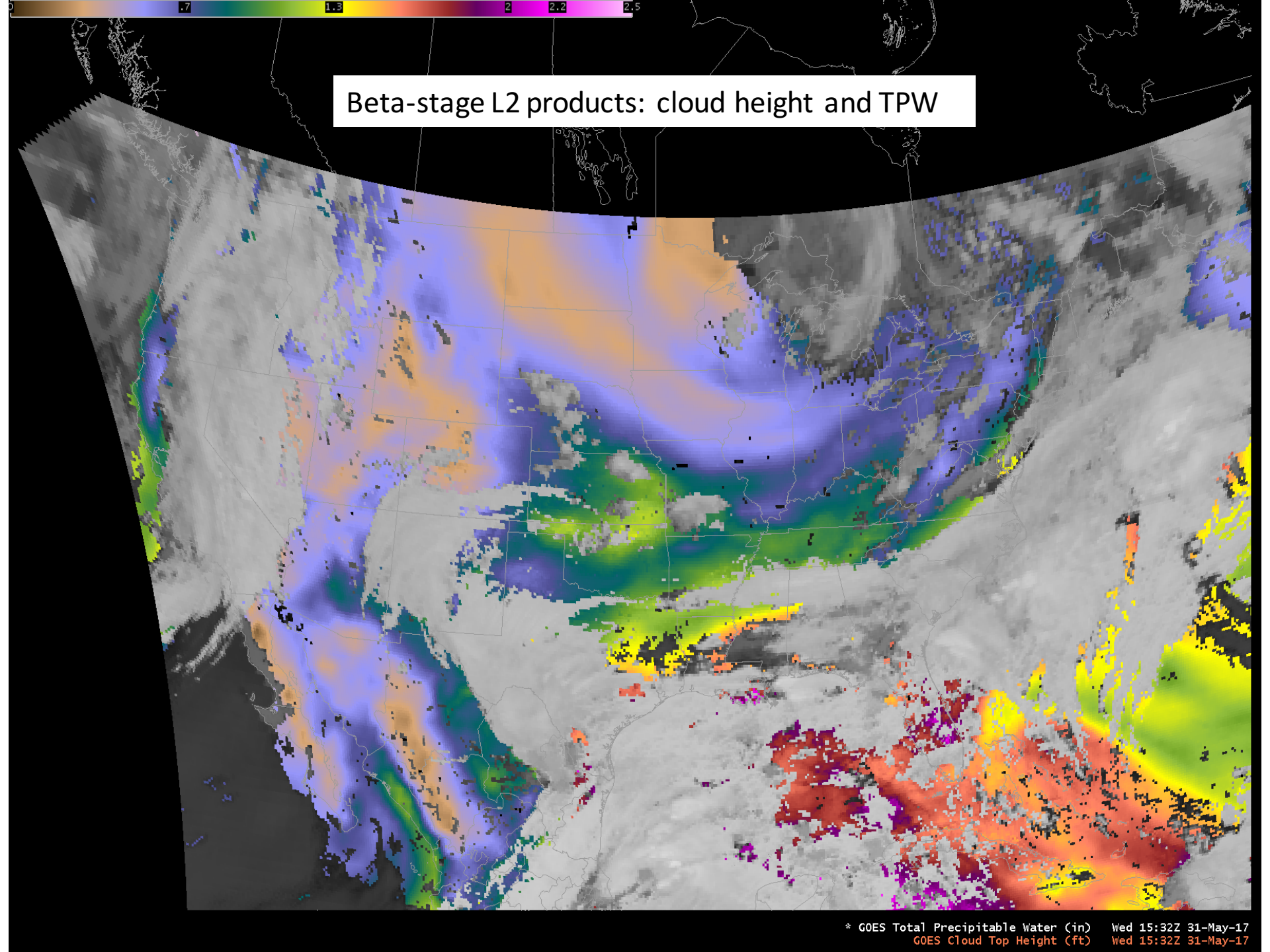
Optimal Footprint Size (Nominally 2km and 4km) From 75W and 137W with Proposed CONUS/PACUS Sectors

The spatial resolution from the GOES-R ABI is better than current GOES to 120 degrees West. (And improved temporal resolution beyond that)

GOES Imager and GOES-16 ABI ICT Noise Estimates




GOES-R Baseline Products
Cloud and Moisture Imagery
Clear Sky Mask
Cloud Optical Depth
Aerosol Optical Depth
Cloud Particle Size Distribution
Aerosol Detection (Smoke and Dust)
Cloud Top Height/Cloud Layer
Cloud Top Phase
Lightning Detection - Events, Groups & Flashes
Hurricane Intensity Estimation
Cloud Top Pressure
Cloud Top Temperature
Sea Surface Temperature (Skin)
Fire/Hot Spot Characterization
Land Surface Temperature
Derived Motion Winds
Downward Shortwave Radiation (Surface)
Legacy Vertical Moisture Profile
Volcanic Ash - Detection & Height
Derived Stability Indices
Legacy Vertical Temperature Profile
Total Precipitable Water
Quantitative Precipitation Estimation (QPE)
Reflected Shortwave Radiation (TOA)
Snow Cover
Many critical derived quantities
http://www.goes-r.gov


.7
1.3
2
2.2
2.5
Beta-stage L2 products: cloud height and TPW
* GOES Total Precipitable Water (in) Wed 15:32Z 31-May-17
GOES Cloud Top Height (ft) Wed 15:32Z 31-May-17

GOES-R Series web sites

- *http://www.goes-r.gov*
- *http://cimss.ssec.wisc.edu/goes-r/*
- *http://cimss.ssec.wisc.edu/goes/goesr.html*

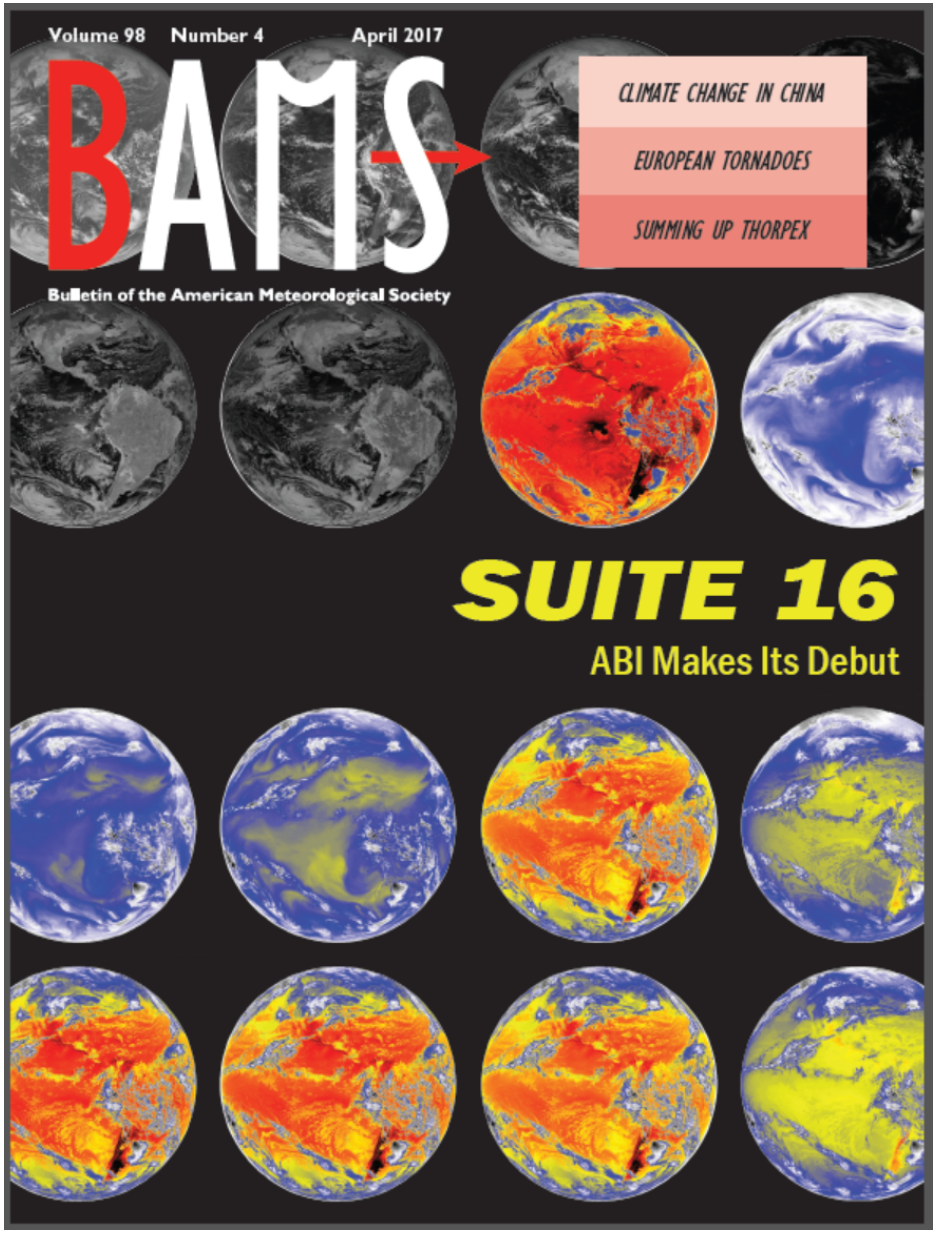
Lockheed Martin

GOES-16 data shown are preliminary, experimental, during on-orbit testing.

A Closer Look at the ABI

- http://journals.ametsoc.org/doi/abs/10.1175/BAMS-D-15-00230.1

- April BAMS issue



Summary

1. The GOES-R ABI provides **mission continuity**

2. Two times the **image navigation quality**

3. Three times the **number of bands**

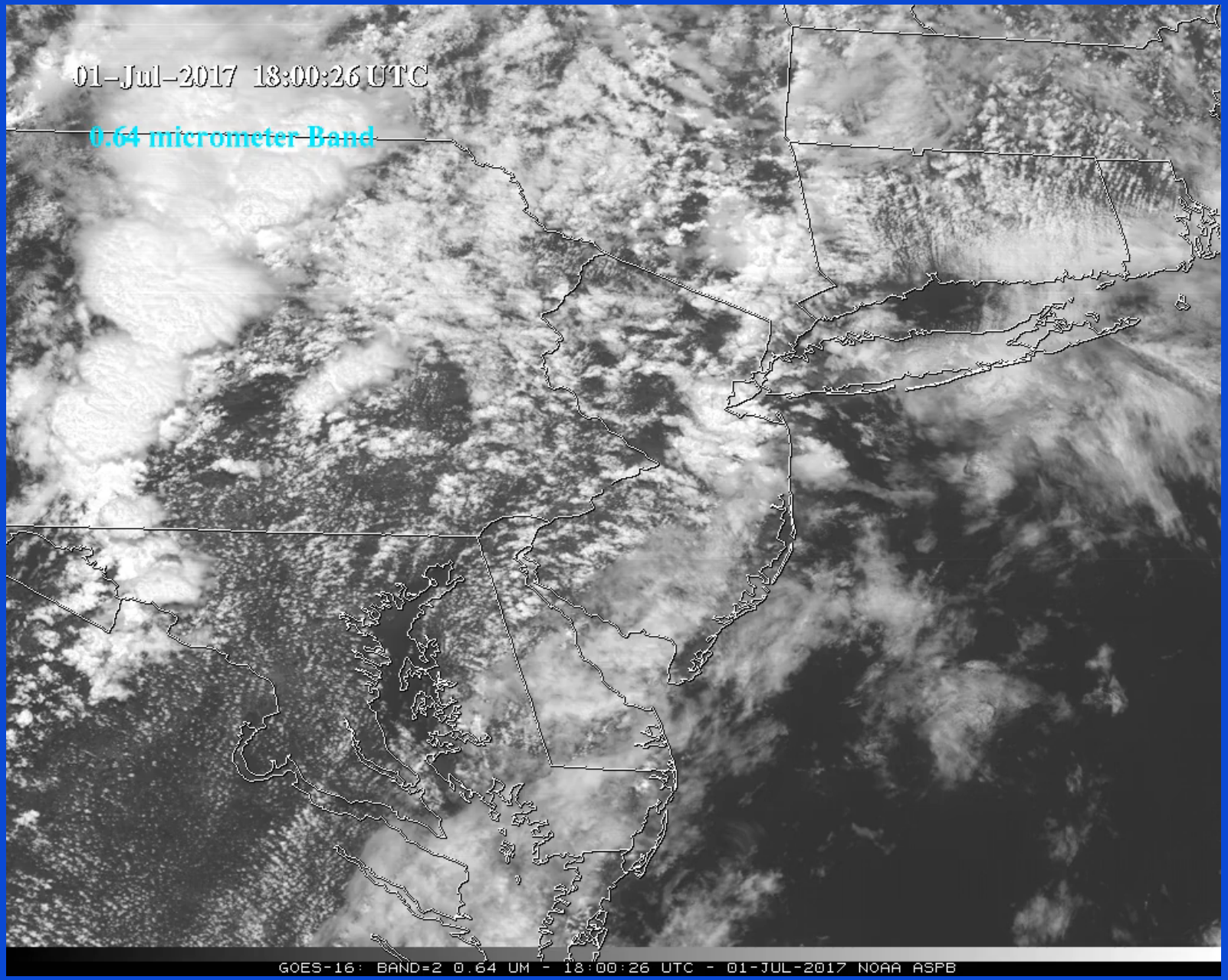
4. Four times the **spatial resolutions**

5. Five times the **coverage rate**

    - Special GOES-14 1-min data pathfinder

http://www.goes-r.gov

GOES-16 ABI: “red” visible band

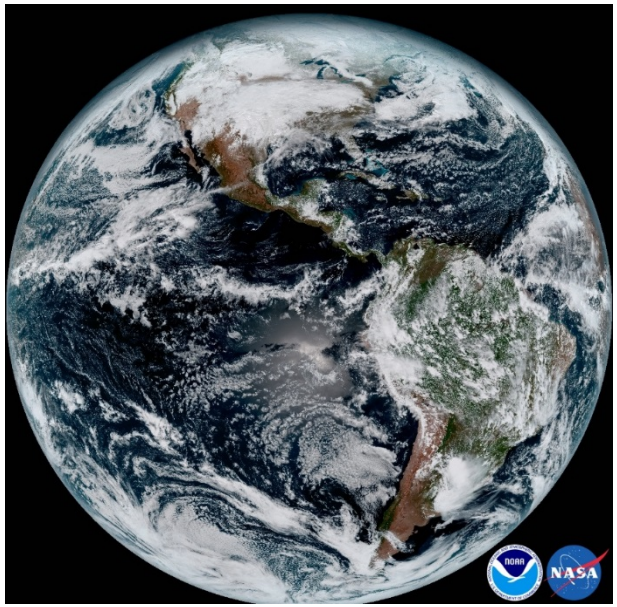


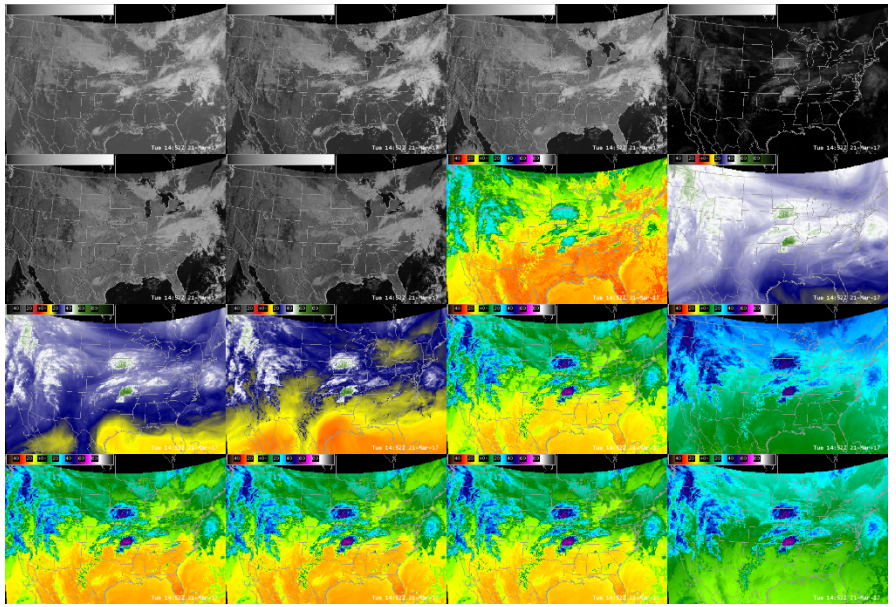
GOES-16 ABI: “enhanced” composite color

Acknowledgements

- The authors would like to thank the entire GOES and GOES-R teams; both within the government, industry and academia.

- The views, opinions, and findings contained in this presentation are those of the authors and should not be construed as an official National Oceanic and Atmospheric Administration or U.S. Government position, policy, or decision.
- GOES-16 data shown are preliminary, experimental, during on-orbit testing.





STAR Center for Satellite Applications and Research
formerly ORA — Office of Research and Applications

SSEC

CIMSS